

DEPARTMENT OF CHEMISTRY

**GOVT. DIGVIJAY PG AUTONOMOUS
COLLEGE, RAJNANDGAON (C.G.)**



SYLLABUS
B.Sc. (Chemistry)

2018 -19

DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
Approved syllabus for B.Sc. CHEMISTRY by the members of Board
of Studies for the Session
2018 -19

The syllabus with the paper combinations is as under

B.Sc. I:

Paper I: INORGANIC CHEMISTRY	Paper II: ORGANIC CHEMISTRY
Paper III : PHYSICAL CHEMISTRY	Practical : CHEMISTRY

B.Sc.II :

Paper I: INORGANIC CHEMISTRY	Paper II: ORGANIC CHEMISTRY
Paper III : PHYSICAL CHEMISTRY	Practical: CHEMISTRY

B.Sc. III:

Paper I: INORGANIC CHEMISTRY	Paper II: ORGANIC CHEMISTRY
Paper III : PHYSICAL CHEMISTRY	Practical: CHEMISTRY

The syllabus for B.Sc. Chemistry is hereby approved for the session 2018 - 19. In case any change or modification is prescribed by Central Board of Studies or Higher Education Department, Govt. of Chhattisgarh with respect to content or distribution of marks for undergraduate syllabi, it will be implemented accordingly.

Name and Signatures	Departmental members
Chairperson /H.O.D	Name and Signatures
Subject Expert (University Nominee)	1.
Subject Expert.....	2.
Representative (Industry)	3.
Representative (Alumni)	4.....
Representative (Professor Science Faculty Other Dept.)	5.
	6.

**Syllabus and Marking Scheme for B.Sc. First Year (Chemistry)
2018-2019**

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	INORGANIC CHEMISTRY	33	33
II	ORGANIC CHEMISTRY	33	
III	PHYSICAL CHEMISTRY	34	
Iv	Practical	50	17
	Total	150	

03 Theory papers	-	100
01 Practical	-	50
Total Marks	-	150

**Syllabus and Marking Scheme for B.Sc. Second Year (Chemistry)
2018-2019**

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	INORGANIC CHEMISTRY	33	33
II	ORGANIC CHEMISTRY	33	
III	PHYSICAL CHEMISTRY	34	
Iv	Practical	50	17
	Total	150	

03 Theory papers	-	100
01 Practical	-	50
Total Marks	-	150

**Syllabus and Marking Scheme for B.Sc. Third Year (Chemistry)
2018-19**

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	INORGANIC CHEMISTRY	33	33
II	ORGANIC CHEMISTRY	33	
III	PHYSICAL CHEMISTRY	34	
Iv	Practical	50	17
	Total	150	

03 Theory papers	-	100
01 Practical	-	50
Total Marks	-	150

DIRECTIVES FOR STUDENTS, FACULTY AND EXAMINERS

1. There shall be three sections (Section A, B and C) in each theory paper.
2. Section A shall contain very short answer type questions (One or two line answer) or objective type questions (fill in the blank). **(no multiple choice questions)**
3. Section B shall contain short answer type questions with maximum limit of 150 words.
4. Section C shall contain long answer/ descriptive type questions. The students are required to answer precisely with maximum limit of 350 words.
5. The students are required to study the content mentioned in the curriculum exhaustively.

EVALUATION PATTERN

➤ **Theory Paper - I & II : 33 marks**

Paper – III : 34 marks

➤ **Practical: 50 marks**

Question Type	MM 33 Paper - I & II (Marks X No. of Q.)	MM 34 Paper - III (Marks X No. of Q.)
A (Very short Ans.)	8 x 1 = 08	1 x 9 = 09
B (Short Ans.)	2 x 5 = 10	2 x 5 = 10
C (Long Ans.)	3 x 5 = 15	3 x 5 = 15

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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. I (CHEMISTRY)
2018-2019

PAPER- I
INORGANIC CHEMISTRY

Max. Marks - 33

UNIT-1 A. Atomic Structure

Idea of de Broglie matter waves, Heisenberg Uncertainty principle, Schrödinger wave equation, significance of Ψ and Ψ^2 , radial and angular wave functions and probability distribution curves, Atomic orbital and shapes of s, p, d, orbital's, Aufbau and Pauli exclusion principles, Hund's Multiplicity rule, electronic configuration of the elements, effective nuclear charge.

B. Periodic Properties

Ionization energy, electron gain enthalpy and electronegativity, trend in periodic table and applications in predicting and explaining the chemical behavior.

UNIT-2 Chemical Bonding

Covalent Bond: Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization & shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2^- and H_2O . M.O. Theory, homonuclear and heteronuclear bond strength & bond energy, percentage ionic character from dipole moment and electronegativity difference.

UNIT-3 Chemical Bonding

Ionic Solids: Ionic structures, radius ratio and co-ordination number, limitations of radius ratio rule, lattice defects, semiconductors, lattice energy, Born-Haber cycle, solvation energy and solubility of ionic solids, polarising power & polarisability of ions, Fajan's rule. Metallic bond -free electron, Valence bond and band theories.

UNIT-4 A. s-Block Elements

Comparative study, salient features of hydrides, solvation and complexation tendencies including their function in biosystems and introduction to alkyl and aryls, derivatives of alkali and alkaline earth metals.

B. Chemistry of Nobles Gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in Xenon compounds.

UNIT-5 A. p-Block Elements

Halides hydrides, oxides and oxyacids of Boron, Aluminium, Nitrogen and Phosphorus, boranes, borazines, fullerenes and silicates, interhalogens and pseudohalogens.

B. Inorganic Chemical Analysis

Chemical principles involved in the detection of acids and basic radicals Including interfering radicals.

LIST OF REFERENCE BOOKS:

1. Basic Inorganic Chemistry, F.A.Cotton, G. Wilkinson and P.L.Gaus, Wiley.
2. Concise Inorganic Chemistry, J.D. Lee, ELBS.
3. Concepts of models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and Alexander, John Wiley.
4. Inorganic Chemistry, D.E.Shriver, P.W.Atkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield, Addison Wesley.
6. Inorganic Chemistry, A.G. Shap, ELBS.
7. Inorganic Chemistry, G.L.Micssles and D.A.Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agrawal & Agrawal.
10. Advanced Inorganic Chemistry, Puri & Sharma, S. Naginchand.
11. Inorganic Chemistry, Madan, S.Chand.
12. Aadhunik Akarbanic Rasayan, A.K.Shrivastav & P.S.Jain, Goel Pub.
13. Ucchattar Akarbanic Rasayan, Satya Prakash & G.D.Tuli, Shyamlal Prakashan.
14. Ucchattar Akarbanic Rasayan, Puri & Sharma.
15. Akarbanic Rasayan, Bhagchandani, Satya Publication.
16. Rasayan Vigyan, Bhatnagar, Arun Prakashan.

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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. I (CHEMISTRY)
2018-2019

PAPER- II
ORGANIC CHEMISTRY

Max. Marks - 33

UNIT-1 Electronic Structure and Bonding

A. Resonance, hyperconjugation, inductive and other field effects, Aromaticity, hydrogen bonding.

B. Mechanism of Organic Reactions

Homolytic and heterolytic bond breaking, types of reagents-electrophiles and nucleophiles. Structure and reactivity of reaction intermediates - carbocations, carbanions, free radicals, carbenes, and nitrenes.

UNIT-2 Stereochemistry of Organic Compounds

A. Optical isomerism - enantiomers, diastereomers, threo and erythro meso compound, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, Sequence rules, D & L and R & S systems of nomenclature.

B. Geometrical Isomerism – Syn and anti forms, E and Z system of nomenclature, properties of cis-trans isomers.

UNIT-3 Aliphatic and Aromatic Ring Compounds

A. Cycloalkanes - Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

B. Arenes and Aromaticity

Mono-nuclear and polynuclear aromatic ring, Structure of benzene and naphthalene, molecular formula and Kekule structure Aromatic electrophilic substitution, General pattern of mechanism, role of σ & π complexes, Electrophilic substitution in naphthalene.

UNIT-4 Alkenes, Dienes and alkynes

A. Mechanism of dehydration of alcohols.

B. Chemical reactions of alkenes: Mechanisms involved in electrophilic and free radical additions, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, Substitution at the allylic and vinylic positions of alkenes. Structure of allenes and

butadiene, Chemical reactions-1, 2 and 1, 4 additions, Diels-Alder reaction.

Chemical reactions of alkynes and acidity of alkynes, electrophilic and nucleophilic addition reactions, hydroboration-oxidation with ozone and KMnO_4 .

UNIT-5 Alkyl Halides and Aryl Halides

A. Mechanism and stereochemistry of nucleophilic substitution reactions of alkyl halides and aryl halides with energy profile diagrams, $\text{S}_{\text{N}}1$, $\text{S}_{\text{N}}2$, $\text{S}_{\text{N}}\text{i}$ mechanism.

B. Mechanism and stereochemistry of elimination reactions of alkyl halides, Elimination vs Substitution.

LIST OF REFERENCE BOOKS:

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, L.G.Wade Jr. Prentice-Hall.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry, Vol.-I, II & III S.M. Mukherjee, S.P.Singh and R.P.Kapoor, Wiley-eastern (New-Age).
5. Organic Chemistry, FA Carey, MC Graw Hill.
6. Introduction to Organic Chemistry, Struieweisser, Heathcock and Kosover, Macmillan.
7. Organic Chemistry, P.L.Soni.
8. Organic Chemistry, Bahl & Bahl.
9. Organic Chemistry, Joginder Singh.
10. Carbanic Rasayan, Bahl & Bahl.
11. Carbanic Rasayan, R.N.Singh, S.M.I.Gupta, M.M.Bakodia & S.K.Wadhwa.
12. Carbanic Rasayan, Joginder Singh.
13. Carbanic Rasayan, P.L.Soni.
14. Carbanic Rasayan, Bhagchandani, Sahitya Bhawan Publication.
15. Rasayan Vigyan, Bhatnagar, Arun Prakashan.

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DEPARTMENT OF CHEMISTRY
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B.Sc. I (CHEMISTRY)
2018-2019

PAPER- III
PHYSICAL CHEMISTRY

Max. Marks - 34

- UNIT-1** **A . Mathematical Concepts for Chemist And Computer**
Logarithmic relations, curve sketching, linear graphs, properties of straight line slope and intercepts, Differentiation of functions, Partial differentiation, Integration of some useful & relevant functions, Maxima and minima. Permutation and combinations, Probability.
- B. Computers**
General introduction to computers, components of computer, hardware and software, input and output devices; binary numbers. Introduction to computer languages. Programming, Operating systems.
- UNIT-2** **A. Molecular velocities:** Root mean square velocity, average and most probable velocities, Maxwell's law of distribution of molecular velocities of gases (Graphical interpretation), effect of temperature on distribution of molecular velocities, collision frequency, mean free path, Joule Thompson effect, Liquefaction of gases
- B.** Deviation from ideal behavior, Real gases, Vander Waals equation of state. Relationship between Vander Waals constant and critical constants, law of corresponding state.
- UNIT-3** **A. Liquid State**
Intermolecular forces, magnitude of intermolecular force structure of liquids, properties of liquids, viscosity and surface tension
- B.** Ideal and non ideal solutions, modes of representing concentration of solutions, activity and activity coefficient.
Dilute solution: Colligative properties, lowering of vapour pressure of solvent, Raoult's law, osmosis, Vant Hoff theory of dilute solution measurements of Osmotic pressure, relationship between lowering of vapour pressure & osmotic pressure. Elevation of boiling point, Depression in freezing point, abnormal molar masses, depression of dissociation and association of solutes, Vant Hoff factor.

UNIT-4 A. Liquid crystals

Difference between liquid crystal, solid and liquids, Classification, Structure of nematic and cholesteric phases. Thermography, seven segment cell. Application of liquid crystals.

B. Colloidal State

Classification, optical, kinetic and electrical properties of colloid Coagulation Hardy Schulze law, Flocculation value, Protection, Gold number, Emulsion, Micelle, Gel, Syneresis and Thixotropy, Application of colloids

C. Solid State

Space lattices, unit cells. Elements of symmetry in crystalline solids, X-rays diffraction, miller indices, identification of unit cell by Bragg's Spectrometer, Powder method, neutron and electron diffraction (Elementary idea only).

UNIT-5 A. Chemical Kinetics

Rate of reaction, Factors influencing the rate of reaction, rate constant, order and molecularity of reactions zero order, first order, second order reaction, Methods of determining order of the reaction complex reactions, Consecutive, opposing and side reactions, chain reactions

Temperature dependence of reaction rate, Arrhenius theory, physical significance of activation energy, collision theory, demerits of collision theory, non mathematical concept of transition state theory.

B. Catalysis

Homogeneous and Heterogeneous catalysis, types of catalyst, characteristics of catalyst, Enzyme catalysed reactions, micellar catalysed reactions, Industrial applications of catalysis.

LIST OF REFERENCE BOOKS:

1. Physical Chemistry, G.M. Barrow, International student edition, MC Graw Hill.
2. Basic Programming with application, V.K. Jain, Tata Mc Graw-Hill.
3. Computers and common sense, R.Hunt and Shelly, Prentice-Hall.
4. University general chemistry, C.N.R. Rao Macmillan.
5. Physical Chemistry, R.A. Alberty, Wiley Eastern.
6. The elements of Physical Chemistry, P.W. Atkin, Oxford.
7. Physical chemistry through problems, S.K. Dogra and Dogra, Wiley Eastern.
8. Physical Chemistry, B.D. Khosla.
9. Physical Chemistry, Puri and Sharma.
10. Bhoutic Rasayan, Puri, Sharma and Pathania, Vishal Publishing Company.
11. Bhoutic Rasayan P.L. Soni.

12. Bhoutic Rasayan Bahl and Tuli.
13. Bhoutic Rasayan I.R. Gambhir.
14. Bhoutic Rasayan, Bhagchandani, Sahitya Bhawan Publication.
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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B. Sc PART- I
CHEMISTRY PRACTICAL
2018-19

Max. Marks - 50

The following experiments are to be conducted during the curriculum.

1. Inorganic Chemistry

Semi micro Analysis – cations analysis, separation and identification of ions from Pb^{2+} , Bi^{3+} , Cu^{2+} , Cd^{2+} , Sb^{3+} , Sn^{2+} , Sn^{4+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Ni^{2+} , Co^{2+} , Zn^{2+} , Mn^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+} , NH_4^+ and Anions CO_3^{2-} , SO_3^{2-} , S^{2-} , SO_4^{2-} , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , CH_3COO^- , $\text{C}_2\text{O}_4^{2-}$, BO_3^{3-} , F^- .

2. Organic chemistry

- i. Calibration of Thermometer
 $80^\circ - 82^\circ$ (Naphthalene), $113.5^\circ - 114^\circ$ (Acetanilide), $132.5^\circ - 133^\circ$ (Urea), 100° (Distilled Water).
- ii. Determination of Melting Point
Naphthalene $80^\circ - 82^\circ$, Benzoic acid $121.5^\circ - 122^\circ$, Urea $132.5^\circ - 133^\circ$, Succinic acid $184.5^\circ - 185^\circ$, Cinnamic acid $132.5^\circ - 133^\circ$, Salicylic acid $157.5^\circ - 158^\circ$, Acetanilide $113.5^\circ - 114^\circ$, m-Dinitrobenzene 90° , p-Dichlorobenzene 52° , Aspirin 135° .
- iii. Determination of boiling points
Ethanol 78° , Cyclohexane 81.4° , Toluene 110.6° , Benzene 80° .
- iv. Mixed Mating point determination
Urea – Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1).
- v. Distillation (Demonstration)
Simple distillation of ethanol-water mixture using water condenser.
Distillation of nitrobenzene and aniline using air condenser.
- vi. Crystallization
Phthalic acid from hot water (using fluted filter paper and stemless funnel).
Acetanilide from boiling water.
Naphthalene from ethanol.
Benzoic acid from water.
- vii. Decolorisation and crystallization using charcoal.
Decolorisation of brown sugar with animal charcoal using gravity filtrations crystallization and decolorisation of impure naphthalene (100 g of naphthalene mixed with 0.3g of Congo red using 1 g of decolorizing carbon) from ethanol.
- vii. Sublimation
Camphor, Naphthalene, Phthalic acid and Succinic acid.

- ix. Qualitative Analysis
Detection of elements (N, S and halogens) and functional groups (Phenolic, Carboxylic, Carbonyl, Esters, Carbohydrates, Amines, Amides, Nitro and Anilide) in simple organic compounds.

3. Physical Chemistry

- (i) **Chemical Kinetics**
To determine the specific rate of hydrolysis of methyl/ethyl acetate catalysed by hydrogen ions at room temperature.
To study the effect of acid strength on the hydrolysis of an ester.
To compare the strengths of HCl & H₂SO₄ by studying the kinetics of hydrolysis of ethyl acetate.
- (ii) **Distribution Law**
To study distribution of iodide between water & CCl₄.
To study distribution of benzoic acid between benzene and water.
- (iii) **Colloids**
To prepare arsenious sulphide sol and compare the precipitating power of mono, bi and tri-valent anions.
- (iv) **Viscosity & Surface Tension**
To determine the % compositions of a given mixture (Non interacting system) by viscosity method.
To determine the viscosity of amyl alcohol in water at different concentrations & calculate the excess viscosity of these solutions.
To determine the % composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

LIST OF REFERENCE BOOKS:

1. Vogel's qualitative analysis, Orient Longman.
2. Standard methods of chemical analysis, W.W. Scott., The Technical Press.
3. Experimental Organic Chemistry, Vol-I & II P.R.Singh, D.S.Gupta & K.S. Bajpai, Tata Mc Graw Hill.
4. Manual Inorganic Chemistry, R.K.Bansal Wiley Eastern.
5. Vogel's text book of practical organic chemistry, B.S. Furnis, A.J.Hannaford, V.Rogers, P.W.G.Smith & A.R.Tatchel, ELBS.
6. Experiments in general chemistry, CNR Rao & U.C.Agrawal.
7. Experiments in physical chemistry, R.C.Das & B.Behara Tata Mc Graw Hill.
8. Advanced practical physical chemistry, J.B.Yadav, Goel Publishing House.

DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
PRACTICAL EXAMINATION

Three experiments are to be performed

Max. Marks : 50

1. Inorganic Mixture Analysis, four radicals two basic & two acid (insoluble, interfering and combination of acid radicals) any one to be given.

12 Marks

2. Detection of functional group in the given organic compound and determine its MP/BP.

8 Marks

OR

Crystallization of any one compound as given in the prospectus along with the determination of mixed MP.

OR

Decolorization of brown sugar along with sublimation of camphor/naphthalene.

3. Any one physical experiment that can be completed in two hours including calculations

14 Marks

4. Viva

10 Marks

5. Sessionals

06 Marks

In case of Ex-students two marks will be added to each of the experiments.

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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. II (CHEMISTRY)

2018-2019
PAPER- I
INORGANIC CHEMISTRY

Max. Marks - 33

- UNIT-1** **Chemistry of elements of first transition series**
Characteristic properties of d-block elements. Properties of elements of first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.
- UNIT-2** **Chemistry of elements of second & third transition series**
General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.
- UNIT-3** **A. Oxidation and Reduction**
Use of redox potential data analysis of redox cycle, redox stability in water-Frost, Latimer & Pourbaix diagrams. Principles involved in the extraction of the elements.
B. Coordination compounds
Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.
- UNIT-4** **A. Chemistry of Lanthanide Elements**
Electronic structure, oxidation states, ionic radii, lanthanide contraction, complex formation, occurrence and isolation and lanthanide compounds.
B. Chemistry of Actinides
General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium, similarities between the later actinides and later lanthanides.
- UNIT-5** **A. Acids and Bases**
Arrhenius, Bronsted – Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

B. Non-aqueous solvents

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvent with reference to liquid ammonia and liquid sulphur dioxide.

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1. Basic Inorganic chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.
2. Concise Inorganic chemistry, J.D. Lee, ELBS.
3. Concept of models of Inorganic Chemistry, B.Douglas, D. McDaniel and J. Alexander, John Wiley.
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6. Inorganic Chemistry, A.G. Sharpe, ELBS.
7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. Advance Inorganic Chemistry, Satya Prakash.
9. Advance Inorganic Chemistry, Agrawal & Agrawal.
10. Advance Inorganic Chemistry, Puri & Sharma, S.Naginchand.
11. Inorganic Chemistry, Madan, S.Chand.
12. Aadhunik Akarbanic Rasayan, A.K.Shrivastava & P.C.Jain, Goel Pub.
13. Uchattar Akarbanic Rasayan, Puri & Sharma.
14. Selected topics in inorganic chemistry by Madan, Malik & Tuli, S. Chand.

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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. II (CHEMISTRY)

2018-2019
PAPER- II
ORGANIC CHEMISTRY

Max. Marks - 33

UNIT-1

Alcohols

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

B. Trihydric alcohols – nomenclature and methods of formation, chemical reactions of glycerol.

Phenols

A. Structure and bonding, in phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols, acylation and carboxylation.

B. Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben – Hoesch reaction, Lederer-Manasse reaction and Reimer- Tiemann reaction.

Epoxides

Synthesis of epoxides. Catalysed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides. Anti 1,2 dihydroxylation of alkenes via epoxides. Crown ethers.

UNIT-2

Aldehydes and Ketones

A. Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones using 1, 3 dithianes, synthesis of ketones from nitriles.

Mechanism of nucleophilic additions to carbonyl group -

Benzoin, Aldol, Perkin and Knoevenagel condensations. Condensations with ammonia and its derivatives, Wittig reaction. Mannich reaction.

B. Use of acetate as protecting group, oxidation of aldehydes, Baeyer Villiger oxidation of ketones, Cannizzaro reaction, Meerwein Ponderff Verley (MPV), Clemmensen condensation, Wolff – Kishner, LiAlH_4 and NaBH_4 reduction. Halogenation of enolizable ketones. An introduction to α , β -unsaturated aldehydes and ketones.

UNIT-3

A. Carboxylic Acids

Structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Hell-Volhard-Zelinsky reaction, reduction of carboxylic acids. Mechanism of decarboxylation.

Methods of formation and chemical reactions of unsaturated mono carboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

B. Substituted Carboxylic Acids

Hydroxy and Halo-substituted Acids

C. Carboxylic Acid Derivatives

Structure of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Mechanisms of acid and base catalysed esterification and hydrolysis.

UNIT-4

Organic compounds of Nitrogen

A. Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitro alkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline medium.

B. Reactivity, Structure and nomenclature of amines, physical properties. Stereo-chemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel- phthalimide reaction, Hoffmann bromamide reaction, reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

UNIT-5

Heterocyclic compounds

A. **Introduction** Molecular orbital picture and aromatic character of pyrrole, furan, thiophene and pyridine, methods of synthesis and chemical reactions with emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

B. Preparation and reaction of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bishler- Napieralski synthesis. Mechanism of electrophilic substitution reaction of indole, quinoline and isoquinoline.

Amino Acids and Peptides

A. Classification, structure and stereochemistry of amino acids. Acid - base behavior, isoelectric point and electrophoresis. Preparation and reactions of α -amino acids.

B. Structure and nomenclature of peptides. Peptide synthesis, solid-phase peptide synthesis.

LIST OF REFERENCE BOOKS:

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, L.G.Wade, Jr.Prentice-Hall.
3. Fundamental of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry, Vol-I, II & III , S.M.Mukherjee, S.P.Singh and R.P.Kapoor, Wiley-Eastern (New-Age).
5. Organic Chemistry, F.A.Carey, McGraw Hill.
6. Introduction of Organic Chemistry, Streiweisser, Heathcock and Kosover, Macmillian.
7. Organic Chemistry, P.L.Soni.
8. Organic Chemistry, Bahl & Bahl.
9. Organic Chemistry, Joginder Singh.
10. Carbanic Rasayan, Bahl & Bahl.
11. Carbanic Rasayan, R.N.Singh, SML Gupta, M.M.Bakodia & S.K.Wadhwa.
12. Organic Chemistry, Joginder Singh.

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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. II (CHEMISTRY)

2018-2019
PAPER- III
PHYSICAL CHEMISTRY

Max. Marks - 34

- UNIT-1** **A. Thermodynamics – I**
Fundamental of thermodynamics system, surroundings etc., types of systems, intensive and extensive properties. State and path functions Thermodynamic operations internal energy, enthalpy, heat capacity of gases at constant volume and at constant pressure and their relation- ship.
First Law of Thermodynamics: Limitation of first law Statement, Joule–Thomson expansion, inversion temperature of gases. Calculation of w , q , dU and dH for the liquification expansion of ideal gases under isothermal and adiabatic conditions.
B. Thermochemistry: Standard state Hess’s law of heat summation, Enthalpy of reaction at constant pressure and constant volume. Enthalpy of neutralization. Enthalpy of combustion, Enthalpy of formation, calculation of bond enthalpy, Kirchhoff’s equation.
- UNIT-2** **A. Thermodynamics - II**
Second Law of Thermodynamics: Spontaneous process need of second law, statements of the Carnot cycle and its efficiency of heat engine, Carnot theorem. Thermodynamic scale of temperature.
Concept of entropy: Entropy change in reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gases, physical significance of entropy .
B. Gibbs & Helmholtz free energy variation of G and A with pressure, volume temperature, Gibbs-Helmholtz equation.
- UNIT-3** **Phase Equilibrium**
A. Gibb’s phase rule, phase components and degree of freedom, limitation of phase rule
Applications of phase rule to one component system– water and sulphur systems.
Applications of phase rule to two component system- Pb-Ag system, Zn- Mg system, $FeCl_3$ - H_2O system desilverisation of lead. Congruent and incongruent, Meltingpoint, eutectic point.

Three component system: solid solution , liquid pairs.
Liquid-Liquid mixtures: Partially miscible liquids – Phenol water system, Trimethylamine –water- nicotine – systems, constant temperature, azeotropes.

B. Nernst distribution law, Henry's law, applications, solvent extraction

UNIT-4 Electrochemistry-I

A. Electrolytic conductance: Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations.

B. Theories of strong electrolyte: limitations of Ostwald's dilution law, weak and strong electrolytes, Debye-Huckel-Onsager's equation for strong electrolytes , relaxation and electrophoretic effects

C. Migration of ions: Transport number, definition and determination by Hittorf method and moving boundary method.

UNIT-5 Electrochemistry-II

A. Electrochemical cell and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells, EMF of the cell and effect of temperature on EMF of the cell, Nernst equation Calculation of ΔG , ΔH and ΔS for cell reactions.

B. Single electrode potential : standard hydrogen electrode, calomel electrode, quinhydrone electrode, redox electrodes, electrochemical series,

C. Concentration cell with and without transport, liquid - junction potential, application of concentration cells in determining of valency of ions , solubility product and activity coefficient .

D. Determination of pH and pKa , using hydrogen and quinhydrone electrodes potentiometric titration. Buffers solution, Henderson-Hasselbalch equation, hydrolysis of salts, Corrosion-types , theories and prevention.

LIST OF REFERENCE BOOKS :

1. Physical chemistry, G.M.Barrow. international student edition McGraw Hill.
2. University general chemistry, CNR Rao, Macmillan.
3. Physical Chemistry R.A.Alberty, Wiley Eastern.
4. The elements of physical chemistry Eastern.
5. Physical Chemistry through problems, S.K.Dogra, Wiley Eastern.

6. Physical Chemistry B.D.Khosla.
7. Physical Chemistry, Puri & Sharma.
8. Bhoutic Rasayan, puri & Sharma.
9. Bhoutic Rasayan, P.L.Soni.
10. Bhoutic Rasayan, Bahl & Tuli.
11. Physical Chemistry, R.L.Kapoor, Vol- I-IV.

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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. PART – II
CHEMISTRY PRACTICAL
2018-19

Max. Marks : 50

Inorganic Chemistry

Calibration of fractional weights, pipettes and burettes. Preparation of standard solutions, Dilution – 0.1 M to 0.01 M solutions.

Quantitative Analysis

Volumetric Analysis

- (a) Determination of acetic acid in commercial vinegar using NaOH.
- (b) Determination of alkali content-antacid tablet using HCl.
- (c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- (d) Estimation of hardness of water by EDTA.
- (e) Estimation of ferrous & ferric by dichromate method.
- (f) Estimation of copper using thiosulphate.

Instrumentation

Colorimetry

- (a) Job's method
- (b) Mole-ratio method
Adulteration-Food Stuffs.
Effluent analysis, water analysis

Solvent Extraction

Separation and estimation of Mg (H) and Fe (H).

Ion Exchange Method

Separation and estimations of Mg (H) and Zn (H)

Organic Chemistry

Laboratory Techniques

A. Thin layer chromatography

Determination of R_f values and identification of organic compounds.

- (a) Separation of green leaf pigments (spinach leave may be used)
- (b) Preparation and separation of 2, 4 dinitrophenyl hydrazones of acetone, 2- butanone, hexan-2-one and hexan-3-one using toluene and light petroleum (40:60)
- (c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8:5:1:5)

B. Paper Chromatography : Ascending & circular.

Determination of R_f -values and identification of organic compounds.

- (a) Separation of mixture of phenylalanine and glycine. Alanine and aspartic acid, Leucine and glutamic acid, Spray reagent-ninhydrin.
- (b) Separation of mixture of D, L-alanine, glycine and L-Leucine using n-butanol : acetic acid : water (4:1:5), Spray reagent ninhydrin.
- (c) Separation of monosaccharides- a mixture of D-galactose and d-fructose using n-butanol : acetone : water (4:5:1), Spray reagent-aniline hydrogen phthalate.

Qualitative Analysis

Identification of an organic compound through the functional group analysis, determination of m.pt. and preparation of derivatives. (aliphatic and aromatic).

Physical Chemistry

Transition Temperature

Determination of the transition temperature of the given substance by thermometric / dilatometric method (e.g. $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}/\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$).

Phase Equilibrium

- 1 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 .
- 2 To construct the phase diagram of two component system (e.g. diphenylamine – benzophenone) by cooling curve method.

Thermo Chemistry

- 1 To determine the solubility of benzoic acid at different temperature and to determine ΔH of the dissolution process.
- 2 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.
- 3 To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

LIST OF REFERENCE BOOKS:-

1. Vogel's qualitative Analysis, revised Svehla, Orient Longman.
2. Standard methods of chemical analysis, W.W. Scott, the Technical press.
3. Experimental Organic Chemistry, Vol I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
4. Vogel's Text book of Practical Organic Chemistry, B.S. Furnis, A.J. Hannaford, V. Rogers, P.W.G.S and A.R. Tatchel, ELBS
5. Laboratory Manual in Organic chemistry, R.K. Bansal, Wiley Eastern.
6. Experiments in Physical Chemistry R.C.Das & B.Behra, Tata McGraw Hill.
7. Experiments in General Chemistry C.N.R.Rao & U.C.Agrawal
8. Advanced Practical Chemistry, J.B.Yadav, Goel Publishing House.

DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON

B.Sc. II

Chemistry Practical Examination

Duration: **5hrs.**

Max. Marks : 50

1. Inorganic – One experiment from synthesis and analysis by preparing the standard solution be given

12 marks

OR

One experiment from instrumentation either by colorimetry / solvent extraction / ion exchange method.

2. (a) Identification of the given organic compound and determine its m.pt. / B.pt.

6 marks

- (b) Determination of R_f value and identification of organic compounds by paper chromatography.

6 marks

3. Any one physical experiment that can be completed in two hours.

12 marks

4. Viva

10 marks

5. Sessional

4 marks

In case of ex students one mark will be added to each of the experiments.

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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. III (CHEMISTRY)
2018-2019
PAPER- I
INORGANIC CHEMISTRY

Max. Marks - 33

- UNIT-1 Metal-ligand Bonding in Transition Metal Complexes**
Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal- field parameters.
Thermodynamic and Kinetic Aspects of Metal Complexes:
A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.
- UNIT-2 Magnetic Properties of Transition Metal Complexes**
Types of magnetic behaviour, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.
Electronic Spectra of Transition Metal Complexes:
Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states. spectrochemical series. Orgel-energy level diagram for d^1 and d^2 states, discussion of the electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.
- UNIT-3 Organometallic Chemistry**
Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and nature of bonding in metal carbonyls.
- UNIT-4 Bioinorganic Chemistry**
Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{2+} , Nitrogen fixation.
- UNIT-5 (A) Hard and Soft Acids and Bases (HSAB)**
Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength, hardness and softness. Symbiosis,

(B) Silicones and Phosphazenes

Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

LIST OF REFERENCE BOOKS:

1. Basic Inorganic chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.
2. Concise Inorganic chemistry, J.D. Lee, ELBS.
3. Concept of models of Inorganic chemistry, B. Douglas, D. McDaniel and J. Alexander, John Wiley.
4. Inorganic Chemistry, D.E. Shriver, P.W. Atkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield. Addison – Wesley.
6. Inorganic Chemistry, A.G. Sharpe, ELBS.
7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. Advance Inorganic Chemistry, Satya Prakash.
9. Advance Inorganic Chemistry, Agrawal & Agrawal.
10. Advance Inorganic Chemistry, Puri & Sharma, S.Naginchand.
11. Inorganic Chemistry, Madan, S.Chand.
12. Aadhunik Akarbanic Rasayan, A.K.Shrivastava & P.C.Jain, Goel Pub.
13. Ucchattar Akarbanic Rasayan, Puri & Sharma.
14. Selected topics in Inorganic chemistry by Madan, Malik & Tuli, S. Chand.

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B.Sc. III (CHEMISTRY)

2018-2019
PAPER- II
ORGANIC CHEMISTRY

Max. Marks - 33

- UNIT-1**
- A. Organometallic Compounds**
Organomagnesium compounds: The Grignard Reagents-formation, structure and chemical reactions Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.
- B. Organosulphur Compound**
Nomenclature, structural features, methods of formation and chemical reactions of thiols; thioethers, sulphonic acids, sulphonamides and sulphaguanidine.
- C. Organic Synthesis via Enolates**
Active methylene group alkylation of diethyl malonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate; the Claisen Condensation. Keto-enol tautomerism of ethyl acetoacetate.
- UNIT-2**
- BIOMOLECULES**
- A. Carbohydrates**
Configuration of monosaccharides. Erythro and threo diastereomers. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)-glucose. Structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.
- B. Protein and nucleic acid:**
Classification and structure of proteins, levels of protein structure, protein denaturation/renaturation, constituents of amino acid, ribonucleocides and ribonucleotides and double helical structure of DNA
- UNIT-3**
- A. Synthetic polymers**
Addition or chain-growth polymerization. Free radical vinyl polymerization, Ziegler-Natta polymerization. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

B. Synthetic Dyes

Colour and constitution (electronic concept). Classification of dyes. Chemistry of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.

UNIT-4 Spectroscopy-I

A. Mass spectroscopy: Mass spectrum, fragmentation of functional group.

B. Infrared spectroscopy: IR absorption band, their position and intensity, identification of IR spectra.

C. UV/Visible spectroscopy: Beer-Lambert law, effect of conjugation. λ_{max} , visible spectrum and colour

D. Anthocyanin as natural colouring matter (introduction only)

E. Application of Mass; Infrared spectroscopy, Ultraviolet spectroscopy to organic molecules

UNIT 5 Spectroscopy-II:

A. NMR Spectroscopy: Introduction to NMR, shielding and number of signals in PMR, chemical shift and characteristics value, splitting of signals and coupling constants, application of Inorganic molecules.

B. ^{13}C NMR spectroscopy: Principle and applications.

C. Magnetic resonance imaging(MRI): Introductory idea

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3. Fundamental of Organic Chemistry, Solomons, John Wiley.
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DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. III (CHEMISTRY)

2018-2019
PAPER- III
PHYSICAL CHEMISTRY

Max. Marks - 34

- UNIT-1 Quantum Mechanics -I**
Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. De Broglie idea of matter waves, Experimental verification of Heisenberg's uncertainty principle, Sinusoidal wave equation, Operator: Hamiltonian operator, angular momentum operator
Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Schrodinger time independent wave equation, physical significance of ψ & ψ^2 , application of Schrodinger wave equation to particle in a one dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.
- UNIT-2 Quantum Mechanics-II**
Quantum Mechanical approach of Molecular orbital theory, basic ideas-criteria for forming M.O. and A.O., LCAO approximation, formation of H_2^+ ion, calculation of energy levels from wave functions, bonding and antibonding wave functions, Concept of σ , σ^* , π , π^* orbitals and their characteristics, Hybrid orbitals- sp , sp^2 , sp^3 Calculation of coefficients of A.O.'s used in these hybrid orbitals.
Introduction to valence bond model of H_2 , comparison of M.O. and V.B. models. Huckel theory, application of Huckel theory to ethene, propene, etc.
- UNIT-3 Spectroscopy-I**
Introduction: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of calculated Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotator, isotopic effect.
Vibrational Spectrum: Fundamental vibration and their symmetry vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, diatomic vibrating operator, anharmonic oscillator

Raman spectrum: Concept of polarizability, quantum theory of Raman spectra, Stokes and anti-Stokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra.

UNIT-4 Spectroscopy-II

Electronic Spectrum: Electronic Spectra of diatomic molecule, Franck-Condon principle, types of electronic transition application of electronic spectra.

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry; Grothus-Draper law, Stark-Einstein law. Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples.)

UNIT-5 A. Thermodynamics

Energy referred to absolute zero, third law of thermodynamics, test of III law of thermodynamics Nernst heat theorem, application and limitation of Nernst heat theory.

B. Physical properties and molecular structure : polarization of molecules (Clausius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method. dipole moment and structure of molecules

C. Magnetic properties: Paramagnetism, diamagnetism and ferromagnetism, determination of magnetic susceptibility, elucidation of molecular structure

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2. University General Chemistry, CNR Rao, Macmillan.
3. Physical Chemistry R.A. Alberty, Wiley Eastern.
4. The elements of Physical Chemistry P.W. Atkins, Oxford.
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9. Bhoutic Rasayan, P.L. Soni.
10. Bhoutic Rasayan, Bahl & Tuli.
11. Physical Chemistry, R.L. Kapoor, Vol- I-IV.
12. Introduction to quantum chemistry, A.K. Chandra, Tata McGraw Hill.

13. Quantum Chemistry, Ira N. Levine, Prentice Hall.

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Representative (Alumni)	4.....
Representative (Professor Science Faculty Other Dept.)	5.
	6.

DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. Part- III
CHEMISTRY PRACTICAL

Max. Marks : 50

INORGANIC CHEMISTRY

Synthesis and Analysis:

- (a) Preparation of sodium trioxalato ferrate (III), $\text{Na}_3 [\text{Fe} (\text{C}_2\text{O}_4)_3]$ and determination of its composition by permanganometry.
- (b) Preparation of Ni-DMG complex $[\text{Ni} (\text{DMG})_2]$
- (c) Preparation of copper tetra amine complex, $[\text{Cu} (\text{NH}_3)_4] \text{SO}_4$
- (d) Preparation of cis-and-trans-bisoxalato diaqua chromate (III) ion.

Gravimetric Analysis: Analysis of Cu as CuSCN or CuO , Ni as $\text{Ni} (\text{DMG})_2$, Ba as BaSO_4 and Fe as Fe_2O_3 .

ORGANIC CHEMISTRY

Laboratory Techniques

A. Steam Distillation:

- (i) Naphthalene from its suspension in water.
- (ii) Clove oil from cloves
- (iii) Separation of o-and p-nitro phenols.

B. Column Chromatography:

- (i) Separation of fluorescein and methylene blue.
- (ii) Separation of leaf pigments from spinach leaves.
- (iii) Resolution of racemic mixture of (\pm) mandelic acid

Qualitative Analysis:

Analysis of an organic mixture containing two solid components using water, NaHCO_3 , NaOH for separation and preparation of suitable derivatives.

Synthesis of Organic Compounds:

- (a) Acetylation of Salicylic acid, aniline, glucose and hydroquinone. Benzoylation of aniline and phenol.
- (b) Aliphatic electrophilic substitution. Preparation of iodoform from ethanol and acetone
- (c) Aromatic electrophilic substitution

Nitration:

- (i) Preparation of m-dinitrobenzene.
- (ii) Preparation of p-nitroacetanilide

Halogenation:

- (i) Preparation of p-bromoacetanilide
- (ii) Preparation of 2,4,6-tribromophenol
- (d) Diazotization/coupling: Preparation of methyl orange and methyl red
- (e) Oxidation: Preparation of benzoic acid from toluene,

- (f) Reduction: (i) Preparation of aniline from nitrobenzene (ii) Preparation of m-nitro aniline from m-dinitrobenzene.

PHYSICAL CHEMISTRY

Electrochemistry

- (a) To determine the strength of the given acid conductometrically using standard alkali solution.
- (b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
- (c) To study the saponification of ethyl acetate conductometrically.
- (d) To determine the ionisation constant of a weak acid conductometrically.
- (e) To titrate potentiometrically the given ferrous ammonium sulphate using KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ as titrant and calculate the redox potential of $\text{Fe}^{2+} / \text{Fe}^{3+}$ system on the hydrogen scale.

Refractometry, Polarimetry

- (a) To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
- (b) To determine the specific rotation of a given optically active compound.

Molecular Weight Determination

- (a) Determination of molecular weight of a non-volatile solute by Rast method/Backmann freezing point method.
- (b) Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

Colorimetry

To verify Beer Lambert law for KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given solution of the substance.

LIST OF REFERENCE BOOKS :

1. Vogel's qualitative Analysis, revised Svehla, Orient Longman.
2. Standard methods of chemical analysis, W.W. Scott, the Technical press.
3. Experimental Organic Chemistry, Vol I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
4. Vogel's Text book of Practical Organic Chemistry, B.S. Furnis, A.J. Hannaford, V. Rogers, P.W.G.S and A.R. Tatchel, ELBS
5. laboratory Manual in Organic chemistry, R.K. Bansal, Wiley Eastern.
6. Experiments in Physical Chemistry R.C. Das & B. Behra, Tata McGraw Hill.
7. Experiments in General Chemistry C.N.R. Rao & U.C. Agrawal
8. Advanced Practical Chemistry, J.B. Yadav, Goel Publishing House.

DEPARTMENT OF CHEMISTRY
GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON
B.Sc. III
Chemistry Practical Examination

Time: 8Hrs.

M.M. 50

Five experiments are to be performed:

1. Inorganic – Two experiments to be performed.
 Gravimetric estimation compulsory carrying **08 marks**
 (Manipulation **03 marks**).
 Any one experiment from synthesis and analysis carrying **04 marks**
2. Organic – Two experiments to be performed.
 Qualitative analysis of organic mixture containing two solid components compulsory carrying **08 marks**
 (**03 marks** for each compound and **02 marks** for separation).
 One exp. from synthesis of organic compound (single step) carrying **04 marks**
3. Physical – One physical experiment carrying **12 marks**
4. Sessional – **04 marks**
5. Viva voce – **10 marks**

In case of ex-student **01** mark each will be added to gravimetric analysis and qualitative analysis of organic mixture and **02** marks in physical experiment.

Name and Signatures	Departmental members Name and Signatures
Chairperson /H.O.D	
Subject Expert (University Nominee)	1.
Subject Expert.....	2.
Representative (Industry)	3.
Representative (Alumni)	4.....
Representative (Professor Science Faculty Other Dept.)	5.
	6.