DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. PART – I, II, III
CHEMISTRY

SESSION : 2021-22

ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A^+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

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DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved syllabus for B.Sc. CHEMISTRY by the members of Board of Studies for the Session 2021-22

The syllabus with the paper combinations is as under

B. Sc. Part - I:

Paper I: BCH-01 INORGANIC CHEMISTRY	Paper II: BCH-02 ORGANIC CHEMISTRY
Paper III: BCH-03 PHYSICAL CHEMISTRY	BCHL-01 Practical: LAB COURSE - 01

B. Sc. Part - II:

Paper I: BCH-04 INORGANIC CHEMISTRY	Paper II: BCH-05 ORGANIC CHEMISTRY
Paper III: BCH-06 PHYSICAL CHEMISTRY	BCHL-02 Practical: LAB COURSE - 02

B. Sc. Part - III:

Paper I: BCH-07 INORGANIC CHEMISTRY	Paper II: BCH-08 ORGANIC CHEMISTRY
Paper III: BCH-09 PHYSICAL CHEMISTRY	BCHL-03 Practical: LAB COURSE - 03

Syllabus of all courses of B.Sc. Part–III have been revised as prescribed by Central Board of Studies/ Higher Education Department, Govt. of Chhattisgarh with respect to content.

The syllabus for B.Sc. Chemistry is hereby approved for the session 2021 -22.

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D		
Subject Expert ..... (University Nominee)	1.....	8.....
	2.....	9.....
Subject Expert.....	3.....	10.....
Representative ..... (Industry)	4.....	11.....
	5.....	12.....
Representative ..... (Alumni)	6.....	13.....
Representative ..... (Professor Science Faculty Other Dept.)	7.....	14.....

DIRECTIVES FOR STUDENTS OF B.Sc. PART-I, II & III

EVALUATION PATTERN

Theory Paper - I & II: 33 marks; Paper – III: 34 marks

Practical: 50 marks

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B &C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (**No Multiplechoice questions, No 'Fill in the blank' type Questions**)
3. Section B shall contain short answer type questions with the limit of 150words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely, and the answer should not exceed the limit of 350words.
5. The scheme of marks should be as follows:

Question Type	MM 33 (Marks x No. of Questions)	MM 34 (Marks x No. of Questions)
A (Very ShortAnswer)	8x1 = 08	1x9 = 09
B (Short Answer)	2x5 = 10	2x5 = 10
C (Long Answer)	3x5= 15	3x5= 15

6. The half yearly internal examinations will be held for Part-I, Part-II & Part III. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annualexamination.

NAME AND SIGNATURE:

Chairperson /H.O.D..... Subject Expert..... (University Nominee) Subject Expert..... Representative..... (Industry) Representative..... (Alumni) Representative ..... (Professor Science Faculty Other Dept.)	Departmental members:

B.Sc. (with CHEMISTRY)

Programme Specific Outcome (PSO):

Upon completion of the B.Sc. Degree (with Chemistry), the students would be able:

PSO1: To have a firm foundation in the fundamentals/concepts/theories and its applications in various branches of chemistry.

PSO2: To explain/compare the various aspects and present the concepts of chemistry effectively.

PSO3: To understand the structure and properties of atoms/molecules/compounds and characteristics/mechanisms of chemical reactions.

PSO4: To analyze problems and apply the principles/concepts in finding their solutions.

PSO5: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments.

PSO6: To carry out experiments, record the observations and present the inference/results.

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Representative ..... (Professor Science Faculty Other Dept.)	7.....	14.....

DEPARTMENT OF CHEMISTRY

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

Approved syllabus for

B.Sc. CHEMISTRY by the members of Board of Studies for the Session

2021-22

Syllabus and Marking Scheme for B.Sc. Part I(2021-22)

Paper No.	Course Code	Title of the Paper	Marks Allotted in Theory	
			Max	Min
I	BCH-01	INORGANIC CHEMISTRY	33	33
II	BCH-02	ORGANIC CHEMISTRY	33	
III	BCH-03	PHYSICAL CHEMISTRY	34	
	BCHL-01	Practical	50	17
		Total	150	50

03 Theory papers	100
01 Practical	50
Total Marks	150

Note: The half yearly internal examinations will be held. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

The syllabus for B.Sc. Chemistry is hereby approved for the session 2021-22.

NAME AND SIGNATURE:

Chairperson /H.O.D	Departmental members:
Subject Expert	
(University Nominee)	
Subject Expert.....	
Representative.....	
(Industry)	
Representative.....	
(Alumni)	
Representative	
(Professor Science Faculty Other Dept.)	

B.Sc. Part - I (CHEMISTRY)
2021-22
PAPER- I(BCH-01)
INORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, students would be able:

CO1: To have knowledge of atomic structure, wave mechanical concept of atom and electronicconfiguration of elements.

CO2: To understand about periodic properties and their variations along periods and groups.

CO3: To explainchemical bonding involved in ionic and covalent compounds.

CO4: To gain insight into valence bond theory, molecular orbital theory and concept of hybridization.

CO5: To describe theproperties of s, p block elements and noble gases.

CO6: To understand the concept and develop skill for qualitative analysis of inorganic mixture.

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	2.....	9.....
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Representative ..... (Alumni)	6.....	13.....
	7.....	14.....
Representative ..... (Professor Science Faculty Other Dept.)		

B.Sc. Part - I (CHEMISTRY)
2021-22
PAPER- I (BCH-01)
INORGANIC CHEMISTRY

Max. Marks - 33

UNIT-1 A. ATOMIC STRUCTURE

Bohr's theory, its limitation and atomic spectrum of hydrogen atom. General idea of de-Broglie matter-waves, Heisenberg uncertainty principle, Schrödinger wave equation, significance of Ψ and Ψ^2, radial & angular wave functions and probability distribution curves, quantum numbers, Atomic orbital and shapes of s, p, d orbitals, Aufbau and Pauli exclusion principles, Hund's Multiplicity rule, electronic configuration of the elements.

B. PERIODIC PROPERTIES

Detailed discussion of the following periodic properties of the elements, with reference to s and p- block. Trends in periodic table and applications in predicting and explaining the chemical behavior.

a) Atomic and ionicradii,
b) Ionizationenthalpy,
c) Electron gainenthalpy,
d) Electronegativity, Pauling's, Mulliken's, Allred Rochow'sscales.
e) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodictable.

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UNIT-2 CHEMICALBONDING-I

Ionic bond: Ionic Solids - Ionic structures, radius ratio & co-ordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy Born- Haber cycle, Solvation energy and solubility of ionic solids, polarising power &polarisabilitry of ions, Fajans rule, Ionic character in covalent compounds: Bond moment and dipole moment, Percentage ionic character from dipole moment and electronegativity difference, Metallic bond-free electron, Valence bond & bandtheories.

UNIT-3 CHEMICALBONDING-II

Covalent bond: Lewis structure, Valence bond theory and its limitations, Concept of hybridization, Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O, NH_3, PCl_3, PCl_5, SF_6. H_3O^+, SF_4, ClF_3, and ICl_2^- Molecular orbital theory. Bond order and bond strength, Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, F_2, CO,NO.

UNIT-4 A. s-BLOCKELEMENTS

General concepts on group relationships and gradation properties, Comparative study, salient features of hydrides, solvation & complexation tendencies including their function in biosystems and introduction to alkyl & aryls, Derivatives of alkali and alkaline earth metals.

B. p-BLOCKELEMENTS

General concepts on group relationships and gradation properties. Halides, hydrides, oxides and oxyacids of Boron, Aluminum, Nitrogen and Phosphorus. Boranes, borazines, fullerenes, graphene and silicates, interhalogens and pseudohalogens.

UNIT-5 A. CHEMISTRY OF NOBLEGASES

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

B. THEORETICAL PRINCIPLES IN QUALITATIVE ANALYSIS (H2S SCHEME) Basic principles involved in the analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

REFERENCE BOOKS:

1. Lee, J. D. Concise Inorganic Chemistry ELBS,1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of InorganicChemistry
3. Oxford,1970
4. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
5. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications,1962.
6. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition,2002.
7. Puri, B. R., Sharma, L. R. and Kalia, K. C., Principles of Inorganic Chemistry, Milestone Publishers/ Vishal Publishing Co.; 33rd Edition2016
8. Madan, R. D. Modern Inorganic Chemistry, S Chand Publishing,1987.

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NAME AND SIGNATURE:

Chairperson /H.O.D..... Subject Expert..... (University Nominee) Subject Expert..... Representative (Industry) ..... Representative (Alumni)	Representative..... (Professor Sc. Faculty Other Dept.) Departmental members)

B. Sc. I (CHEMISTRY)
2021-22
PAPER- II(BCH-02)
ORGANICCHEMISTRY

Course Outcome (CO):

After completion of the course, the students would be able:

CO1:To explain the basic concepts of organic reactions, reaction mechanism, reaction intermediates
various types of organic reactions.

CO2:To learn the terminology associated with stereochemistry, impact of chirality on optical activity and geometrical isomerism.

CO3: To understand the conformation of alkanes and cycloalkanes, Baeyer'sstrain theory and conformations of substituted cycloalkanes.

CO4: To interpret the reactions, properties and mechanisms of reactions involved in alkanes, alkenes and alkynes.

CO5: To describe the aromaticity and mechanisms of typical aromatic reactions.

NAME AND SIGNATURE:

	Departmental members	
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Subject Expert.....	3.....	10.....
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Representative ..... (Professor Science Faculty Other Dept.)		

B. Sc. Part - I (CHEMISTRY)
2021-22
PAPER- II (BCH-02)
ORGANIC CHEMISTRY

Max. Marks - 33

UNIT-I BASICS OF ORGANICCHEMISTRY

Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment. Electrophiles and Nucleophiles; Nucleophilicity and basicity; Homolytic and Heterolytic cleavage, Generation, shape and relative stability of Carbocations, Carbanions, Free radicals, Carbenes and Nitrenes. Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.

UNIT-II INTRODUCTION TOSTEREOCHEMISTRY

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, meso compounds, Relative and absolute configuration: Fischer, Newmann and Sawhorse Projection formulae and their interconversions; Erythrose and threose, D/L, d/l system of nomenclature, Cahn-Ingold-Prelog system of nomenclature (C.I.P rules), R/S nomenclature. Geometrical isomerism: cis–trans, syn- anti and E/Z notations.

UNIT-III CONFORMATIONAL ANALYSIS OFALKANES

Conformational analysis of alkanes, ethane, butane, cyclohexane and sugars. Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Theory of strainless rings, Chair, Boat and Twist boat conformation of cyclohexane with energy diagrams; Relative stability of mono-substituted cycloalkanes and disubstitutedcyclohexane.

UNIT-IV CHEMISTRY OF ALIPHATICHYDROCARBONS

A. Carbon-Carbon sigma (σ)bonds:

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reaction, Free radical substitutions: Halogenation-relative reactivity and selectivity.

B. Carbon-Carbon Pi (л)bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions and mechanisms (Markownikoff/Anti - Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT-V AROMATICHYDROCARBONS

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/ carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directive effects of the groups.

LIST OF REFERENCE BOOKS:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(PearsonEducation).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
4. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London,1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International,2005.
6. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
7. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition(1998).
8. A Guide Book of Reaction Mechanism by PeterSykes.

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NAME AND SIGNATURE:

Chairperson /H.O.D..... Subject Expert..... (University Nominee) Subject Expert..... Representative..... (Industry) Representative..... (Alumni) Representative ..... (Professor Science Faculty Other Dept.)	Departmental members:

B. Sc. I (CHEMISTRY)
2021-22
PAPER- III (BCH-03)
PHYSICALCHEMISTRY

Course Outcome (CO):

After completion of the course, the students will be able:

CO1:To have a firm foundation of the basic mathematical concepts useful for chemists and itsapplications.
CO2: To understand the kinetic molecular model of a gas, laws related to ideal gases and behaviour of real gases.
CO3: To explain thechemistry of liquid state- intermolecular forces, structure and properties of liquids.
CO4: To classify different colloids and discuss the principles, properties and application of colloids, adsorption and adsorption isotherms.
CO5: To explain the basics of solid state – crystal lattices, various terms, laws of crystallography, symmetry and X-ray diffraction.
CO6: To define various terms associated with chemical kinetics, derive rate equations/rate laws and describe various theories of rate, types of catalysis, catalysts and its industrial applications.

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B. Sc. Part - I (CHEMISTRY)
2021-22
PAPER- III (BCH-03)
PHYSICAL CHEMISTRY

Max. Marks - 34

UNIT-1 MATHEMATICAL CONCEPTS FORCHEMIST

Basic Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs, Properties of straight line, slope and intercept, Functions, Differentiation of functions, maxima and minima; integrals; ordinary differential equations; vectors and matrices; determinants; Permutation and combination and probability theory, Significant figures and their applications.

UNIT-2 GASEOUS STATECHEMISTRY

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path; Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Joule Thomson effect, Liquification ofGases.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor (Z), and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. Vander Waals equation of state, its derivation and application in explaining real gas behaviour, calculation of Boyle temperature. Isotherms of real gases and their comparison with Vander Waals isotherms, continuity of states, critical state, relation between critical constants and Vander Waals constants, law of corresponding states.

UNIT-3 A. LIQUID STATECHEMISTRY

Intermolecular forces, magnitude of intermolecular force, structure of liquids, Properties of liquids, viscosity and surfacetension.

B. COLLOIDS AND SURFACE CHEMISTRY

Classification, Optical, Kinetic and Electrical Properties of colloids, Coagulation, Hardy Schulze law, flocculation value, Protection, Gold number, Emulsion, micelles and types, Gel, Syneresis and thixotrophy, Application of colloids.
Physical adsorption, chemisorption, adsorption isotherms (Langmuir and Freundlich). Nature of adsorbed state. Qualitative discussion of BET.

UNIT-IV SOLID STATECHEMISTRY

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder patternmethod. Crystal defects.

UNIT-V [A] CHEMICAL KINETICS

Rate of reaction, Factors influencing rate of reaction, rate law, rate constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions,

Rate and Rate Law, methods of determining order of reaction, 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 statetheory.

[B] CATALYSIS

Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristic of catalyst, Enzyme catatysed reactions, Micellarcatatysed reactions, Industrial applications of catalysis.

REFERENCE BOOKS:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 10th Ed., Oxford University Press(2014).
2. Ball, D. W. Physical Chemistry Thomson Press, India(2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa(2004).
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP(2009).
5. Engel, T. & Reid, P. Physical Chemistry 3rd Ed. Pearson(2013).
6. Puri, B.R., Sharma, L. R. and Pathania, M.S., Principles of Physical Chemistry, Vishal Publishing Co., 47th Ed.(2016).
7. Bahl, A., Bahl, B.S. and Tuli, G.D. Essentials of Physical Chemistry, S Chand Publishers(2010).
8. Rakshit P.C., Physical Chemistry, Sarat Book House Ed.(2014).
9. Singh B., Mathematics for Chemist, PragatiPublications.

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DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B. Sc PART - I PRACTICAL

BCHL – 01: LAB COURSE - 01

Max. Marks - 50

Course Outcome (CO):

After completion of the course, the students would be able:

CO1: To understand the semi-micro qualitative analysis.

CO2: To apply the various aspects of titration.

CO3: To learn about laboratory Glass wares and Equipments.

CO4: To study the effect of acid strength on the hydrolysis of an ester.

CO5: To understand purification of organic compounds.

NAME AND SIGNATURE:

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DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B. Sc PART - I PRACTICAL

BCHL – 01: LAB COURSE - 01

Max. Marks - 50

The following experiments are to be conducted during the curriculum.

1. **InorganicChemistry**

[A] Semi-micro qualitative analysis (using H_2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding interfering, insoluble salts) out of the following:

Cat⁴ions : NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^+

Anions : CO_3^{2-} , SO_3^{2-}, SO_4^{2-}, S^{2-}, NO_3^-, $CH\ COO^-$, Cl^-, Br^-, I^-, NO_2^-, (Spot tests may be carried out wherever feasible)

[B] Acid-BaseTitrations

1. Standardization of sodium hydroxide by oxalic acidsolution.
2. Determination of strength of HCl solution using sodium hydroxide asintermediate.
3. Estimation of carbonate and hydroxide present together inmixture.
4. Estimation of carbonate and bicarbonate present together in amixture.
5. Estimation of free alkali present in differentsoaps/detergents

[C] RedoxTitrations

1. Standardization of $KMnO_4$ by oxalic acidsolution.
2. Estimation of Fe(II) using standardized $KMnO_4$solution.
3. Estimation of oxalic acid and sodium oxalate in a givenmixture.
4. Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) as externalindicator.

[D] Iodo / IodimetricTitrations

1. Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solutioniodimetrically.
2. Estimation of (a) arsenite and (b) antimonyiodimetrically.
3. Estimation of available chlorine in bleaching powderiodometrically.
4. Estimation of Copper and Iron in mixture by standard solution of $K_2Cr_2O_7$usingsodium thiosulphate solution astitrants.

2. **ORGANIC CHEMISTRY**

1. Demonstration of laboratory Glasswares andEquipments.
   - Calibration of the thermometer. 80°–82° (Naphthalene), 113.5^o–114° (Acetanilide), 132.5^o- 133° (Urea), 100° (DistilledWater).)
2. Purification of organic compounds by crystallization using differentsolvents.
   - Phthalic acid from hot water (using fluted filter paper and stemlessfunnel).
   - Acetanilide from boilingwater.
   - Naphthalene fromethanol.
   - Benzoic acid fromwater.

3. Determination of the melting points of organiccompounds.

   Naphthalene 80°–82°, Benzoic acid 121.5^{o}–122°, Urea 132.5^{o}–133° Succinic acid 184.5^{o}– 185°, Cinnamic acid 132.5^{o}–133°, Salicylic acid 157.5^{o}–158°, Acetanilide 113.5^{o}–114°, m- Dinitrobenzene 90°, p-Dichlorobenzene 52°, Aspirin 135°.

   - Effect of impurities on the melting point – mixed melting point of two unknown organiccompounds.
   - Urea – Cinnamic acid mixture of various compositions (1:4, 1:1,4:1).

4. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillarymethod).
   - Ethanol 78°, Cyclohexane 81.4^{o}, Toluene 110.6^{o}, Benzene80^{o}.

   i. Distillation(Demonstration)
      - Simple distillation of ethanol-water mixture using watercondenser.
      - Distillation of nitrobenzene and aniline using aircondenser.

   ii. Sublimation
      - Camphor, Naphthalene, Phthalic acid and Succinicacid.

   iii. Decolorisation and crystallization usingcharcoal.
      - Decolorisation of brown sugar with animal charcoal using gravity filtrations crystallization and decolorisation of impure naphthalene (100 g of naphthalene mixed with 0.3 g of Congo red using 1 g of decolorizing carbon) fromethanol.

5. QualitativeAnalysis

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

PHYSICAL CHEMISTRY

1. Surface tensionmeasurements.
   - Determine the surface tension by (i) drop number (ii) drop weightmethod.
   - Surface tension composition curve for a binary liquidmixture.

2. Viscosity measurement using Ostwald'sviscometer.
   - Determination of viscosity of aqueous solutions of (i) sugar (ii) ethanol at room temperature.
   - Study of the variation of viscosity of sucrose solution with the concentrationof solute.
   - Viscosity Composition curve for a binary liquidmixture.

3. ChemicalKinetics
   - To determine the specific rate of hydrolysis of methyl/ethyl acetate catalysedby hydrogen ions at roomtemperature.
   - To study the effect of acid strength on the hydrolysis of anester.
   - To compare the strengths of HCl & H2SO4 by studying the kinetics of hydrolysis of ethylacetate.

4. Colloids
   - To prepare colloidal solution of silver nanoparticles (reduction method) and other metal nanoparticles using cappingagents.

Note: Experiments may be added/ deleted subject to availability of time and facilities

DEPARTMENT OF CHEMISTRY
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PRACTICAL EXAMINATION

05 Hrs. **M.M.50**

Three experiments are to be performed

1. Inorganic Mixture Analysis, four radicals two basic & two acid (excluding insoluble, Interfering & combination of acid radicals) OR Two Titrations (Acid-Bases,RedoxandIodo/Iodimetry) **12marks**
2. Detection of functional group in the given organic compound and determineitsMPt/BPt. **8marks**

   OR

   Crystallization of any one compound as given in the prospectus along with the Determination of mixed MPt.

   OR

   Decolorisation of brown sugar along with sublimation of camphor/ Naphthlene.
3. Any one physical experiment that can be completed in two hours including calculations. **14marks**
4. Viva **10marks**
5. Sessionals **06marks**

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

REFERENCE TEXT:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson,2009.
2. Ahluwalia, V. K., Dhingra, S. and Gulati, A. College practical Chemistry, UniversityPress.
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education(2009)
4. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical OrganicChemistry, 5th Ed., Pearson(2012)
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand& Co.: New Delhi (2011).
6. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8thEd.; McGraw-Hill: New York(2003).
7. Halpern, A. M. &McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman& Co.: New York(2003).

NAME AND SIGNATURE:

Chairperson /H.O.D.....Astbana	Departmental members:
Subject Expert.....	
(University Nominee)	
Subject Expert.....	
Representative.....	
(Industry)	
Representative.....	
(Alumni)	
Representative	
(Professor Science Faculty Other Dept.)	

DEPARTMENT OF CHEMISTRY

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

Approved syllabus for

B.Sc. CHEMISTRY by the members of Board of Studies for the Session

2021-22

Syllabus and Marking Scheme for B.Sc. Part II(2021-22)

Paper No.	Course Code	Title of the Paper	Marks Allotted in Theory	
			Max	Min
I	BCH-04	INORGANIC CHEMISTRY	33	33
II	BCH-05	ORGANIC CHEMISTRY	33	
III	BCH-06	PHYSICAL CHEMISTRY	34	
	BCHL-02	Practical	50	17
		Total	150	50

03 Theory papers	100
01 Practical	50
Total Marks	150

Note: The half yearly internal examinations will be held. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

The syllabus for B.Sc. Chemistry is hereby approved for the session 2021-22.

NAME AND SIGNATURE:

Chairperson /H.O.D	Departmental members:
Subject Expert ..... (University Nominee)	
Subject Expert.....	
Representative..... (Industry)	
Representative..... (Alumni)	
Representative ..... (Professor Science Faculty Other Dept.)	

B.Sc. Part - II(CHEMISTRY)

2021-22
PAPER- I(BCH-04)
INORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, the students would be able:

CO1: To know the meaning of various terms involved in co-ordination Chemistry

CO2: To understand Werner"s formulation of complexes and identify the types of valences.

CO3: To know the limitations of VBT.

CO4: To draw the geometrical and optical isomerism of complexes

CO5: To effectively solve practical problems of analytical chemistry of non-aqueous solutions.

NAME AND SIGNATURE:

Chairperson /H.O.D …… Subject Expert …… (University Nominee) Subject Expert…… Representative…… (Industry) Representative…… (Alumni) Representative …… (Professor Science Faculty Other Dept.)	Departmental members:

B.Sc. Part - II(CHEMISTRY)

2021-22
PAPER- I(BCH-04)
INORGANIC CHEMISTRY
Max. Marks - 33

UNIT-1 **CHEMISTRY OF TRANSITION SERIES ELEMENTS**

Transition Elements: Position in periodic table, electronic configuration, General Characteristics, *viz*., atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions, magnetic moment μso (spin only) and μeff and catalytic behaviour. General comparative treatment of 4d and 5d elements with their 3d analogues with respect to ionic radii, oxidation states and magnetic properties.

UNIT-2 **A. OXIDATION AND REDUCTION**:

Redox potential, electrochemical series and its applications, Principles involved in extraction of the elements.

B. COORDINATION COMPOUNDS:

Werner's theory and its experimental verification, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6coordination numbers. Chelates, polynuclear complexes.

UNIT-3 **COORDINATION CHEMISTRY**

Valence bond theory (inner and outer orbital complexes), electroneutralityrinciple and back bonding. Crystal field theory, Crystal field splitting and stabilization energy, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination.

UNIT-4 **A. CHEMISTRY OF LANTHANIDE ELEMENTS**

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, 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 latter actinides and the latter lanthanides

UNIT-5 **A. ACIDS-BASES**

Arrhenius, Bronsted-Lowry, conjugate acids and bases, relative strengths of acids and bases, 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, reaction in non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide, HF, H2SO4 , Ionic liquids.

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 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 – Wiley.
6. Inorganic Chemistry, A. G. Sharp, ELBS.
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agarwal and Agarwal
10. Advanced Inorganic Chemistry, Puri, Sharma, S. Naginchand
11. Inorganic Chemistry, Madan, S. Chand
12. AadhunikAkarbanicRasayan, A. K. Shrivastav& P. C. Jain, Goel Pub
13. UchchattarAkarbanicRasayan, satya Prakash & G. D. Tuli, ShyamalPrakashan
14. UchchattarAkarbanicRasayan, Puri& Sharma
15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand.

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (**No Multiple choice questions, No 'Fill in the blank' type Questions**)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

Question Type	MM 33 (Marks x No. of Questions)
A (Very short Answer)	8x1 = 08
B (Short Answer)	2x5 = 10
C (Long Answer)	3x5= 15

NAME AND SIGNATURE:

Chairperson /H.O.D ..... Subject Expert ..... (University Nominee) Subject Expert..... Representative..... (Industry) Representative..... (Alumni) Representative ..... (Professor Science Faculty Other Dept.)	Departmental members:

B. Sc. Part - II (CHEMISTRY)

2021-22
PAPER- II(BCH-05)
ORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, the students would be able:

CO1: To illustrate structure and reaction of alkyl and aryl halides, phenol, carbonyl compounds, carboxylic acids and amines.

CO2: To explain difference between nucleophilic substitution and elimination reactions and to predict kinetics and stereochemical aspects of substitution reactions.

CO3: To explain mechanism of nucleophilic addition reactions and reactivity of carbonyls.

CO4: To predict and describe mechanism of name reactions.

CO5: To explain acidity of carboxylic acids based on various field effects.

CO6; To predict basicity and stereochemistry of amines, to illustrate synthetic transformation of aryl diazonium salts.

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B. Sc. Part - II (CHEMISTRY)

2021-22
PAPER- II(BCH-05)
ORGANIC CHEMISTRY
Max. Marks - 33

UNIT-1 **CHEMISTRY OF ORGANIC HALIDES**

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution, elimination reactions.

Aryl halides: Preparation, including preparation from diazonium salts, Nucleophilic Aromatic Substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

UNIT-2 **ALCOHOLS**

A. Alcohols: Nomenclature, preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction for the preparation of alcohols, Dihydric alcohols – methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)4 and HIO4] and pinacol-pinacolone rearrangement.

B. Trihydric alcohols - Nomenclature, 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, acylation and carboxylation.

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

UNIT-3 **ALDEHYDES AND KETONES**

A. Nomenclature, structure and reactivity of carbonyl group. General methods of preparation of aldehydes and ketones.

Mechanism of nucleophilic addition to carbonyl groups: Benzoin, Aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction, Beckmann and Benzil- Benzilic rearrangement.

B. Use of acetate as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen reduction, Wolf-Kishner reaction, LiAlH4 and NaBH4 reduction. Halogenation of enolizable ketones, An introduction to α,β-unsaturated aldehydes and ketones.

UNIT-4 **A. CARBOXYLIC ACIDS**

Preparation, Structure and bonding, Physical and chemical properties including, acidity of carboxylic acids, effects of substituents on acid strength, Hell-VolhardZeilinsky reaction. Reduction of carboxylic groups, Mechanism of decarboxylation.

Di carboxylic acids: Methods of formation and effect of heat and dehydrating agents, Hydroxyacids.

B. CARBOXYLIC ACID DERIVATIVES

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

Mechanism of acid and base catalyzed esterification and hydrolysis.

UNIT-5 **ORGANIC COMPOUNDS OF NITROGEN**

A.Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium.

B. Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry 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 and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hofmann- Bromamide reaction, Reactions of amines, electrophilic aromatic substitution of aryl amines, Reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, Azo coupling.

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 Easters (New Age).
5. Organic Chemistry, F. A. Carey, McGraw Hill.
6. Introduction to Organic Chemistry, Struiweisser, Heathcock and Kosover, Macmillan.
7. Organic Chemistry, P. L. Soni.
8. Organic Chemistry, Bahl and Bahl.
9. Organic Chemistry, Joginder Singh.
10. CarbanicRasayan, R. N. Singh, S. M. I. Gupta, M. M. Bakidia& S. K. Wadhwa.

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (**No Multiple choice questions, No 'Fill in the blank' type Questions**)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

Question Type	MM 33 (Marks x No. of Questions)
A (Very short Answer)	8x1 = 08
B (Short Answer)	2x5 = 10
C (Long Answer)	3x5= 15

NAME AND SIGNATURE:

Chairperson /H.O.D	Departmental members:
Subject Expert..... (University Nominee)	
Subject Expert.....	
Representative..... (Industry)	
Representative..... (Alumni)	
Representative ..... (Professor Science Faculty Other Dept.)	

B. Sc. Part - II (CHEMISTRY)

2021-22
PAPER- III(BCH-06)
PHYSICAL CHEMISTRY

Course Outcome (CO):

After completion of the course, the students would be able:

CO1:To have a firm foundation of thermodynamicsand its applications, explain first and second laws, thermodynamic properties and calculate various thermodynamic functions.

CO2:To discuss the concepts/laws of thermochemistry, heat of reaction and its applications.

CO3:To explain criteria of thermodynamic equilibrium, concept of fugacity, thermodynamic derivation of relations between the various equilibrium constants

CO4:To understand and apply concept of ionic equilibria, salt hydrolysis and buffer solution.

CO5: To define terms related to phase rule and Nernst distribution law and draw and interpret phase diagram and its application.

CO6:To differentiate between thermal and photochemical processes, explain laws of photochemistry, low and high quantum yields, photochemical processes and reactions.

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D		
Subject Expert ..... (University Nominee)	1.....	8.....
	2.....	9.....
Subject Expert.....	3.....	10.....
	4.....	11.....
Representative ..... (Industry)	5.....	12.....
Representative ..... (Alumni)	6.....	13.....
	7.....	14.....
Representative ..... (Professor Science Faculty Other Dept.)		

B. Sc. Part - II (CHEMISTRY)

2021-22
PAPER- III(BCH-06)
PHYSICAL CHEMISTRY

Max. Marks - 34

UNIT-1

A. THERMODYNAMICS-I

Intensive and extensive variables; state and path functions; isolated, closed and open systems; Zeroth law of thermodynamics. First law: Concept of heat, work, internal energy and statement of first law; enthalpy, Relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases under isothermal and adiabatic conditions. Joule-Thomson expansion, inversion temperature of gases, expansion of ideal gases under isothermal and adiabatic condition

B. THERMO CHEMISTRY

Thermochemistry, Laws of Thermochemistry, 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-2

A. THERMODYNAMICS-II

Second Law of Thermodynamics: Spontaneous process, Second law, Statement of Carnot cycle and efficiency of heat engine, Carnot's theorem, thermodynamic state of temperature.

Concept of entropy: Entropy change in a reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gases, physical signification of entropy, Molecular and statistical interpretation of entropy.

B. Gibbs and Helmholtz free energy, variation of G and A with pressure, volume, temperature, Gibbs-Helmholtz equation, Maxwell relations, Elementary idea of Third law of Thermodynamics, concept of residual entropy, calculation of absolute entropy of molecule.

UNIT- 3

A CHEMICAL EQUILIBRIUM

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Concept of Fugacity, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exergonic and endergonic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Thermodynamic derivation of relations between the various equilibrium constants Kp, Kc and Kx. Le Chatelier principle (quantitative treatment). Equilibrium between ideal gas and a pure condensed phase.

B IONIC EQUILIBRIA

Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono protic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

UNIT-4

PHASE EQUILIBRIUM

A. Phase rule, Phase, component and degree of freedom, derivation of Gibbs phase rule, Clausius-Claperon equation and its applications to Solid-Liquid, Liquid-Vapor and Solid-Vapor, limitation of phase rule, applications of phase rule to one component system: Water system and sulphur system.

Application of phase rule to two component system: Pb-Ag system, desilverization of lead, Zn-Mg system, Ferric chloride-water system, congruent and incongruent melting point and eutectic point.

Three component system: Solid solution liquid pairs.

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

UNIT-5 **PHOTOCHEMISTRY**

Characteristics of electromagnetic radiation, Interaction of radiation with matter, difference between thermal and photochemical processes, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry: Grothus-Drapper law, Stark- Einstein law, quantum yield, actinometry, examples of low and high quantum yields, Photochemical equilibrium and the differential rate of photochemical reactions, Quenching, Role of photochemical reaction in biochemical process.

Jablonski diagram depicting various process occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), photosensitized reactions, energy transfer processes {simple examples), photostationary states, Chemiluminescence.

LIST OF REFERENCE BOOKS:

1. Physical Chemistry, R. A. Alberty, Wiley Eastern.
2. Physical Chemistry, B. D. Khosla,.
3. Physical Chemistry, Puri& Sharma.
4. BhautikRasayan, Puri, Sharma and Pathania, Vishal Publishing Company.
5. BhautikRasayan, P. L. Soni.
6. BhautikRasayan, Bahl and Tuli.
7. Physical Chemistry, R. L. Kapoor

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
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3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

Question Type	MM 34 (Marks x No. of Questions)
A (Very short Answer)	1x9 = 09
B (Short Answer)	2x5 = 10
C (Long Answer)	3x5= 15

NAME AND SIGNATURE:

Chairperson /H.O.D	Departmental members:
Subject Expert ..... (University Nominee)	
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DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B.Sc. PART – IIPRACTICAL
BCHL – 02 : LAB COURSE - 02

Course Outcome (CO):

After completion of the course, the students would be able:

CO1: To understand the semi-micro qualitative analysis.

CO2: To apply the various aspects volumetric analysis.

CO3: To learn about qualitative analysis of unknown organic compounds.

CO4: To study the transition temperature of the given substance .

CO5: To understand the enthalpy of solution of solid.

NAME AND SIGNATURE:

Chairperson /H.O.D …… Subject Expert …… (University Nominee) Subject Expert…… Representative…… (Industry) Representative…… (Alumni) Representative …… (Professor Science Faculty Other Dept.)	Departmental members:

DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B.Sc. PART – II PRACTICAL
BCHL – 02 : LAB COURSE - 02

INORGANIC CHEMISTRY

Qualitative semimicro analysis of mixtures containing 5 radicals. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}.

Mixtures should preferably contain one interfering anion, or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions e.g. $CO_3^{2+}$and SO_3^{2-}, $NO_2^-$and NO_3^-, Cl^-, Br^-, and I^-.

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.

- Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions: i. Ni (II) and Co (II) ii. Fe (III) and Al (III)

ORGANIC CHEMISTRY

- Detection of elements (X, N, S).
- Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, nitro, amine, amide, and carbonyl compounds, carbohydrates)
- Preparation of Organic Compounds: (i) m-dinitrobenzene, (ii) Acetanilide, (iii) Bromo/Nitro-acetanilide, (iv) Oxidation of primary alcohols-Benzoic acid from benzylacohol, (v) azo dye.

PHYSICAL CHEMISTRY

Transition Temperature

- Determination of the transition temperature of the given substance by thermometric/ dialometric method (e.g. $MnCl_2.4H_2O$/$SrBr_2.2H_2O$). Thermochemistry
- Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
- Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with

sodium hydroxide.

•To determine the solubility of benzoic acid at different temperature and to determine ΔH of the dissolution process.

• 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.

• 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. Phase Equilibrium

• 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.

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

• Distribution of acetic/ benzoic acid between water and cyclohexane.

• Study the equilibrium of at least one of the following reactions by the distribution method:

(i) $I_2(aq) + I \rightarrow I_3(aq)^{2+}$

(ii) $Cu_2{+}(aq) + nNH_3 \rightarrow Cu(NH_3)n$

Molecular Weight Determination

Determination of molecular weight by Rast Camphor and Landsburger method.

Note: **Experiments may be added/ deleted subject to availability of time and facilities.**

Reference Books

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)
3. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000). 22
4. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011). Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
6. Halpern, A. M. &McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York

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Subject Expert.....	
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Representative..... (Alumni)	
Representative ..... (Professor Science Faculty Other Dept.)	

DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B.Sc. II
Chemistry Practical Examination

Hrs.5 **M.M.50**

Three Experiments are to be performed.

1. Inorganic – Qualitative semimicro analysis of mixtures. **12 marks**

OR

One experiment from synthesis and analysis by preparing the standard solution.

2. (a) Identification of the given organic compound & determine its M.Pt./B.Pt. **6 marks**

(b) Determination of Rf value and identification of organic compounds by paper chromatography. **6 marks**

3. Any one physical experiment that can be completed in two hours including calculations. **12 marks**

4. Viva **10 marks**

5. Sessional **04 marks**

In case of Ex-Students one marks will be added to each of the experiment.

NAME AND SIGNATURE:

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Subject Expert.....	
Representative..... (Industry)	
Representative..... (Alumni)	
Representative ..... (Professor Science Faculty Other Dept.)	

DEPARTMENT OF CHEMISTRY

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

Approved syllabus for

B.Sc. CHEMISTRY by the members of Board of Studies for the Session

2021-22

Syllabus and Marking Scheme for B.Sc. Part III(2021-22)

Paper No.	Course Code	Title of the Paper	Marks Allotted in Theory	
			Max	Min
I	BCH-07	INORGANIC CHEMISTRY	33	33
II	BCH-08	ORGANIC CHEMISTRY	33	
III	BCH-09	PHYSICAL CHEMISTRY	34	
	BCHL-03	Practical	50	17
		Total	150	50

03 Theory papers	100
01 Practical	50
Total Marks	150

Syllabus of all courses of B.Sc. Part–III have been revised as prescribed by Central Board of Studies/ Higher Education Department, Govt. of Chhattisgarh with respect to content.

Note: The half yearly internal examinations will be held. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

The syllabus for B.Sc. Chemistry is hereby approved for the session 2021-22.

NAME AND SIGNATURE:

Chairperson /H.O.D	Departmental members:
Subject Expert	
(University Nominee)	
Subject Expert.....	
Representative.....	
(Industry)	
Representative.....	
(Alumni)	
Representative	
(Professor Science Faculty Other Dept.)	

B.Sc. Part - III (CHEMISTRY)

2021-22

PAPER- I (BCH – 07)

INORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, students would be able:

CO1: To understand about limitation of VBT and concept of CFT and its limitations.

CO2: To know the magnetic properties of complexes and able to interpret spectra of transition metal complexes.

CO3: To understand nomenclature, classification, structure, propertiesand applications of organometallic compounds.

CO4: To know the role of trace and essential elements in biological process structure and mechanism of hemoglobin.

CO5: To understand role of hard and soft acids and bases in chemistry and their structure.

CO6: To acquire knowledge of synthesis, structure and applications of inorganic polymers.

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D		
Subject Expert ..... (University Nominee)	1.....	8.....
	2.....	9.....
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Representative ..... (Alumni)	6.....	13.....
	7.....	14.....
Representative ..... (Professor Science Faculty Other Dept.)		

B.Sc. Part - III(CHEMISTRY)

2021-22
PAPER- I (BCH – 07)
INORGANIC CHEMISTRY
Max. Marks - 33

UNIT-I

METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES

(A) Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn–Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

(B) 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, Trans- effect, theories of trans effect. Mechanism of substitution reactions of square planar complexes.

UNIT-II

MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES

Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of $\mu_{so\ (spin\ only)}$ and $\mu_{eff.}$ 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, spectro-chemical series. Orgel-energy level diagram for d_1 and d_2 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

UNIT-**III**
ORGANOMETTALIC CHEMISTRY

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series.
Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π-acceptor behavior of CO (MO diagram of CO to be discussed), Zeise's salt: Preparation and structure.
Catalysis by Organometallic Compounds –
Study of the following industrial processes and their mechanism :
1. Alkene hydrogenation (Wilkinsons Catalyst)
2. Polymeration of ethane using Ziegler – Natta Catalyst

UNIT IV
BIOINORGANIC CHEMISTRY

Essential and trace elements in biological processes, Excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{2+} and Mg^{2+}, nitrogen fixation.

UNIT V
HARD AND SOFT ACIDS AND BASES (HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, Applications of HSAB principle

INORGANIC POLYMERS
Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones. Silicates, phosphazenes and polyphosphate

REFERENCE BOOK

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 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 – Wiley.

6. Inorganic Chemistry, A. G. Sharp, ELBS.

7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.

8. Advanced Inorganic Chemistry, Satya Prakash.

9. Advanced Inorganic Chemistry, Agarwal and Agarwal.

10. Advanced Inorganic Chemistry, Puri, Sharma, S. Naginchand.

11. Inorganic Chemistry, Madan, S. Chand.

12. AadhunikAkarbanicRasayan, A. K. Shrivastav& P. C. Jain, Goel Pub.

13. UchchattarAkarbanicRasayan, satya Prakash & G. D. Tuli, ShyamalPrakashan.

14. UchchattarAkarbanicRasayan, Puri& Sharma.

15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand

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B. Sc. III (CHEMISTRY)
2021-22
PAPER- II
ORGANICCHEMISTRY

Course Outcome (CO):

After completion of the course, the students would be able:

CO1: To have the fundamental theoretical knowledge about the heterocyclic chemistry.
CO2:To learn about the common organometallic reactions and draw reasonable reaction mechanisms.
CO3: To know about the synthetic applications of enolates and thio compounds.
CO4: To have a general overview on the carbohydrates and their structure illucidation.
CO5:To describe the chemical structure of proteins, amino acids and nucleic acids.
CO6:Toacquire knowledge about different mechanisms involved in polymerization, useful polymers and their structures.
CO7: To know about various synthetic dyes and their structures.
CO8: To be able to explain basic principles of UV-Visible, IR and NMR spectra and their applications.

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B.Sc. Part - III(CHEMISTRY)

2021-22
PAPER- II (BCH – 08)
ORGANIC CHEMISTRY
Max. Marks - 33

UNIT -1

HETEROCYCLIC COMPOUNDS

Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, Pomeranz-Fritsch reaction)

UNIT II

AORGANOMETALLIC REAGENT

Organomagnesium compounds: Grignard reagents formation, structure and chemical reactions.
Organozinc compounds: formation and chemical reactions.
Organolithium compounds: formation and chemical reactions

B.ORGANOSYNTHESIS VIA INOLATES

Active methylene group, alkylation of diethylmalonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Robbinson annulations reaction.

UNIT-III
BIOMOLECULES
A.CARBOHYDRATES

Occurrence, classification and their biological importance. Monosaccharides: relative and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides – Structural comparison of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch and cellulose.

B.AMINO ACIDS,PROTIENS AND NUCLEICACIDS

Classification and Nomenclature of amino acids, Configuration and acid base properties of amino acids, Isoelectric Point, Peptide bonds, Protein structure, denaturation/ renaturation, Constituents of nucleic acid, DNA, RNA nucleoside, nucleotides, double helical structure of DNA

UNIT-IV

A, SYNTHETIC POLYMER

Addition or chain growth polymerization, Free radical vinyl polymerization, Ziegler-Natta polymerization, Condensation or Step growth polymerization, polyesters, polyamides, phenols-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, Alizarine and Indigo.

UNIT-V

A. INFRARED SPECTROSCOPY

Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds.

B. UV-VISIBLE SPECTROSCOPY

Beer Lambert's law, effect of Conjugation, Types of electronic transitions λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour.

C. NMR SPECTROSCOPY

Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant (J); Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds. ^{13}CMR spectroscopy: Principle and applications

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 Easters (New Age).

5. Organic Chemistry, F. A. Carey, McGraw Hill.

6. Introduction to Organic Chemistry, Struiweisser, Heathcock and Kosover, Macmillan.

7. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).

8. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.

9. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning IndiaEdition, 2013.

10. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.

11. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.

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B. Sc. III (CHEMISTRY)
2021-22
PAPER- III (BCH-09)
PHYSICALCHEMISTRY

Course Outcome (CO):

After completion of the course, the students will be able

CO1 : To have a firm foundation of the fundamentals/concepts/principles/postulates of quantum mechanics and understand the need for development of quantum mechanics.

CO2 : To understand the applications of quantum mechanics in the study of black body radiation, photoelectric effect, simple quantum mechanical models, bonding in molecules and molecular spectroscopy.

CO3 : To explain and compare the basic ideas of Valence Bond Theory and Molecular Orbital Theory and apply LCAO method to hydrogen molecular ion, hybrid orbitals and Huckel MO Theory to simple conjugated systems.

CO4 : To describe the fundamentals and applications of electromagnetic spectrum, microwave, infrared, Raman and electronic spectroscopy.

CO5 : To understand basic concepts and theories of electrochemistry and learn about the various aspects of electrochemical cell and its applications.

CO6 : To analyze problems and apply the principles/concepts in finding their solutions.

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Representative ..... (Professor Science Faculty Other Dept.)		

B.Sc. Part - III(CHEMISTRY)

2021-22
PAPER- III (BCH - 09)
PHYSICAL CHEMISTRY

Max Marks 34

UNIT-1
QUANTUM MECHANICS-1

Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. 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-II
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-III
SPECTROSCOPY

Introduction: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotator, isotopic effect.

Vibrational Spectroscopy: Fundamental vibration and their symmetry, vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillator.

Raman spectrum: Concept of polarizability, quantum theory of Raman spectra, stokes and antistokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra.
Electronic Spectroscopy: Basic principles, Electronic Spectra of diatomic molecule, Franck-Condon principle, types of electronic transition, application of electronic spectra.

UNIT-IV
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, Elementary ideas of Debye – Huckel - Onsager's equation for strong electrolytes, relaxation and electrophoretic effects.

C. Migration of ions: Transport number, Determination by Hittorf method and moving boundary method, ionic strength.

UNIT-V
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. Corrosion-types, theories and prevention.

REFERENCE BOOK

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 Eastrn.
4. The elements of Physical Chemistry P.W.Alkin,Oxford.
5. Physical Chemistry through problems, S.K.Dogra, Wiley Eastern.
6. Physical Chemistry B.D.Khosla.
7. Physical Chemistry, Puri& Sharma.
8. BhouticRasayan, Puri& Sharma.
9. BhouticRasayan, P.L.Soni.
10. BhouticRasayan, 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

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (**No Multiple choice questions, No 'Fill in the blank' type Questions**)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

Question Type	MM 34 (Marks x No. of Questions)
A (Very short Answer)	1x9 = 09
B (Short Answer)	2x5 = 10
C (Long Answer)	3x5= 15

NAME AND SIGNATURE:

Chairperson /H.O.D …… Subject Expert …… (University Nominee) Subject Expert…… Representative…… (Industry) Representative…… (Alumni) Representative …… (Professor Science Faculty Other Dept.)	Departmental members:

DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B.Sc. Part- IIIPRACTICAL
BCHL-03: LAB COURSE -03

Course Outcome (CO):

After completion of the course, the students would be able:

CO1: To understand the gravimetric analysis..

CO2: To apply the various rearrangement reactions in synthesis.

CO3: To learn about synthesis of inorganic complexes.

CO4: To learn about synthesis of organic compounds.

CO5: To understand Lambert-Beer's law.

NAME AND SIGNATURE:

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DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B.Sc. Part- IIIPRACTICAL
BCHL-03: LAB COURSE -03

Max. Marks-50

INORGANIC CHEMISTRY

Gravimetry Analysis:

Estimation of nickel (II) using Dimethylglyoxime (DMG).
Estimation of copper as CuSCN
Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.
Estimation of Al (III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminiumoxinate).
Estimation of Barium as $BaSO_4$

Inorganic Preparations:

- Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$
- Cis and trans $K[Cr(C_2O_4)_2.(H_2O)_2]$ Potassium dioxalatodiaquachromate(III)
- Tetraamminecarbonatocobalt (III) ion
- Potassium tris(oxalate)ferrate(III)/ Sodium tris(oxalate)ferrate(III)
- Cu(I) thiourea complex, Bis (2,4-pentanedionate) zinc hydrate; Double salts (Chrome alum/ Mohr's salt)

ORGANIC CHEMISTRY

Preparation of organic compound

- Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-,m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid)
- Benzolyation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, panisidine) and one of the following phenols (β-naphthol, resorcinol, p cresol) by Schotten-Baumann reaction.
- Bromination of any one of the following: a. Acetanilide by conventional methods b.Acetanilide using green approach (Bromate-bromide method)
- Nitration of any one of the following: a. Acetanilide/nitrobenzene by conventional method b. Salicylic acid by green approach (using ceric ammonium nitrate).
- Reduction of p-nitrobenzaldehyde by sodium borohydride.
- Hydrolysis of amides and esters.
- Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
- Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
- Aldol condensation using either conventional or green method.

Benzil-Benzilic acid rearrangement.

- Preparation of sodium polyacrylate.

- Preparation of urea formaldehyde.
- Preparation of methyl orange.

1.The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.
2. Qualitative Analysis Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.
3. Extraction of caffeine from tea leaves.
4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
5. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy. (Spectra to be provided).
6. Estimation of glycine by Sorenson's formalin method.
7. Study of the titration curve of glycine.
8. Estimation of proteins by Lowry's method.
9. Study of the action of salivary amylase on starch at optimum conditions.
10. Effect of temperature on the action of salivary amylase.

PHYSICAL CHEMISTRY

Conductometry

1.Determination of cell constant

2. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

3. Perform the following conductometric titrations:
   i. Strong acid vs. strong base
   ii. Weak acid vs. strong base
   iii. Mixture of strong acid and weak acid vs. strong base
   iv. Strong acid vs. weak base

4. To determine the strength of the given acid conductometrically using standard alkali solution.

5. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically

6. To study the saponification of ethyl acetate conductometrically.

Potentiometry/pH metry

Perform the following potentio/pH metric titrations:
   i. Strong acid vs. strong base
   ii. Weak acid vs. strong base
   iii. Dibasic acid vs. strong base
   iv. Potassium dichromate vs. Mohr's salt
   v. Determination of pKa of monobasic acid

UV/ Visible spectroscopy

1. Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration.
2. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
3. Study the kinetics of iodination of propanone in acidic medium.
4. Determine the amount of iron present in a sample using 1,10-phenathroline.
5. Determine the dissociation constant of an indicator (phenolphthalein).
6. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.
7. Study of pH-dependence of the UV-Vis spectrum (200-500 nm) of potassium dichromate.
8. Spectral characteristics study (UV) of given compounds (acetone, acelaldehyde, acetic acid, etc.) in water.
9. Absorption spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine □max values.

Note: **Experiments may be added/deleted subject to availability of time and facilities**

Reference books

1.Vogel, A.I. Quantitative Organic Analysis, Part 3, Pearson (2012).31

2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

5. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000)

6. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.

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DEPARTMENT OF CHEMISTRY
Govt. V.Y.T. P.G. Autonomous College, Durg

B.Sc. III
Chemistry Practical Examination

Time: 8Hrs.

M.M. 50

Five experiments are to be performed:

1. Inorganic – Two experiments to beperformed.
   Gravimetric estimationcompulsorycarrying **08marks**
   (Manipulation **03** marks).
   Any one experiment from synthesis and analysis carrying**04 marks**

2. Organic – Two experiments to beperformed.
   Qualitative analysis of organic mixture containing two solid components compulsory carrying **08 marks**
   (03 marks for each compound and **02 marks** for separation).
   One experiment from synthesis of organic compound (single step) carrying **04 marks**

3. Physical– One Physicalexperimentcarrying **12 marks**

4. Sessional – **04marks**

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

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