

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. PART – I (Old Course) Chemistry

SESSION : 2022-23



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

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. PART – II & III CHEMISTRY

SESSION : 2022-23



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

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

Department of Chemistry

Govt. V.Y.T. PG Autonomous College Durg (C.G.)



B.Sc.Chemistry

(3 yr Course)

2022-23

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
 2022-23

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

The syllabus for B.Sc. Chemistry is hereby approved for the session 2022-23.

NAME AND SIGNATURE:

	Departmental members	
	1.....	8.....
Chairperson /H.O.D <i>Asmi</i>	<i>[Signature]</i>	<i>[Signature]</i>
Subject Expert (University Nominee)	2..... <i>[Signature]</i>	9..... <i>[Signature]</i>
Subject Expert <i>H. Mahabey</i>	3..... <i>[Signature]</i>	10.....
Representative <i>[Signature]</i> (Industry)	4..... <i>[Signature]</i>	11..... <i>[Signature]</i>
Representative <i>Dr. Bhawana J...</i> (Alumni)	5..... <i>[Signature]</i>	12.....
Representative <i>B. Faruq</i> (Professor Science Faculty Other Dept.)	6..... <i>[Signature]</i>	13.....
	7.....	14..... <i>[Signature]</i>

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 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)	MM 34 (Marks x No. of Questions)
A (Very Short Answer)	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 annual examination.

NAME AND SIGNATURE:

Chairperson /H.O.D..... <i>Abhin</i> Subject Expert..... (University Nominee) Subject Expert..... <i>H. Mahabey</i> Representative..... <i>S</i> (Industry) Representative..... <i>B. Jain</i> (Alumni) Representative..... <i>Shank</i> (Professor Science Faculty Other Dept.)	Departmental members: <i>Arjun</i> <i>Chit</i> <i>Shank</i> <i>Shank</i> <i>Shank</i> <i>Shank</i> <i>Divastar</i> <i>Shank</i> <i>Shank</i> <i>Shank</i>
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B.Sc. (with CHEMISTRY)

Programme Specific Outcome (PSO):

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

PSO1: Understand the fundamentals/concepts/theories in various branches of chemistry.

PSO2: Compare and justify various aspects, deduce and derive expressions, reaction mechanisms, etc.

PSO3: Apply the principles/concepts and rules in finding their solutions.

PSO4: Carry out experiments, record the observations, understand handling of apparatus/instruments.

NAME AND SIGNATURE:

		Departmental members	
Chairperson /H.O.D	<i>A. B. S. W.</i>		
Subject Expert (University Nominee)		1..... <i>[Signature]</i>	8..... <i>[Signature]</i>
Subject Expert..... <i>H. Mahabey</i>		2..... <i>[Signature]</i>	9.....
Representative (Industry)	<i>[Signature]</i>	3..... <i>[Signature]</i>	10.....
Representative (Alumni)	<i>[Signature]</i>	4..... <i>[Signature]</i>	11..... <i>[Signature]</i>
Representative (Professor Science Faculty Other Dept.)	<i>[Signature]</i>	5..... <i>[Signature]</i>	12.....
		6..... <i>[Signature]</i>	13.....
		7.....	14..... <i>[Signature]</i>

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
2022-23

Syllabus and Marking Scheme for B.Sc. Part I(OLD COURSE for ex-students))

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 2022-23.

NAME AND SIGNATURE:

Chairperson /H.O.D <i>Ashi</i>	Departmental members:
Subject Expert	<i>[Signature]</i>
(University Nominee)	<i>[Signature]</i>
Subject Expert <i>H. Honebe</i>	<i>[Signature]</i>
Representative..... <i>[Signature]</i>	<i>[Signature]</i>
(Industry)	<i>[Signature]</i>
Representative..... <i>B. J. a</i>	<i>[Signature]</i>
(Alumni)	<i>[Signature]</i>
Representative <i>[Signature]</i>	<i>[Signature]</i>
(Professor Science Faculty Other Dept.)	<i>[Signature]</i>

B.Sc. Part - I (CHEMISTRY)
2022-23
PAPER- I(BCH-01)
INORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, students would be able:

- CO1:** To understand atomic structure, wave mechanical concept and electronic configuration.
- CO2:** To discuss about periodic properties and their variations along periods and groups.
- CO3:** To explain chemical bonding involved in ionic and covalent compounds.
- CO4:** To gain insight into valence bond theory, molecular orbital theory and concept of hybridization.
- CO5:** To understand the concept and develop skill for qualitative analysis of inorganic mixture.

NAME AND SIGNATURE:

		Departmental members	
Chairperson /H.O.D	<i>Soni</i>		
Subject Expert (University Nominee)		1..... <i>[Signature]</i>	8..... <i>[Signature]</i>
Subject Expert..... <i>[Signature]</i> <i>H. Mahabey</i>		2..... <i>[Signature]</i>	9..... <i>[Signature]</i>
Representative (Industry)	<i>[Signature]</i> <i>52</i>	3..... <i>[Signature]</i>	10.....
Representative		4..... <i>[Signature]</i>	11..... <i>[Signature]</i>
Representative	<i>B. Dix</i>	5..... <i>[Signature]</i>	12.....
Representative (Alumni)		6..... <i>[Signature]</i>	13.....
Representative (Professor Science Faculty Other Dept.)	<i>[Signature]</i>	7.....	14..... <i>[Signature]</i>

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B.Sc. Part - I (Old Course)
2022-23
CHEMISTRY 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 ionic radii,
- b) Ionization enthalpy,
- c) Electron gain enthalpy,
- d) Electronegativity, Pauling's, Mulliken's, Allred Rochow's scales.
- e) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

UNIT-2 CHEMICAL BONDING-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 & polarisability 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 & band theories.

UNIT-3 CHEMICAL BONDING-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-BLOCK ELEMENTS

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-BLOCK ELEMENTS

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 NOBLE GASES

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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 Inorganic Chemistry
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 Edition 2016
8. Madan, R. D. Modern Inorganic Chemistry, S Chand Publishing, 1987.

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B (Short Answer)	2x5 = 10
C (Long Answer)	3x5 = 15

NAME AND SIGNATURE:

Chairperson /H.O.D..... <i>Asst. Prof.</i>	Representative..... <i>[Signature]</i>
Subject Expert.....	(Professor Sc. Faculty Other Dept.)
(University Nominee)	Departmental members:
Subject Expert..... <i>H. Mohabey</i>	<i>[Signatures]</i>
Representative (Industry)	
Representative (Alumni) ... <i>P. Jai</i>	

B. Sc. I (CHEMISTRY)
2022-23
PAPER- II(BCH-02)
ORGANIC CHEMISTRY

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 define terminology associated with stereochemistry, impact of chirality on optical activity and geometrical isomerism.
- CO3:** To understand the conformation of alkanes and cycloalkanes, Baeyer's strain 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	
Chairperson /H.O.D <i>Aswini</i>			
Subject Expert (University Nominee)	1..... 2.....	<i>[Signature]</i> <i>[Signature]</i>	8..... 9..... <i>[Signature]</i> <i>[Signature]</i>
Subject Expert <i>H. Mahabey</i>	3..... 4.....	<i>[Signature]</i> <i>[Signature]</i>	10..... 11..... <i>[Signature]</i>
Representative (Industry)	5.....	<i>[Signature]</i>	12.....
Representative <i>B. Jang</i>	6.....	<i>[Signature]</i>	13.....
Representative <i>[Signature]</i>	7.....		14..... <i>[Signature]</i>
Representative (Professor Science Faculty Other Dept.)			

B. Sc. Part - I (Old Course)
2022-23
CHEMISTRY PAPER- II
(BCH-02)
ORGANIC CHEMISTRY

Max. Marks - 33

UNIT-I BASICS OF ORGANIC CHEMISTRY

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 TO STEREOCHEMISTRY

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 OF ALKANES

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 disubstituted cyclohexane.

UNIT-IV CHEMISTRY OF ALIPHATIC HYDROCARBONS

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 (π) 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 AROMATIC HYDROCARBONS

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:


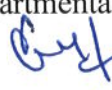











1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
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 Peter Sykes.

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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. I (CHEMISTRY)
2022-23
PAPER- III (BCH-03)
PHYSICAL CHEMISTRY

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 its applications.
- CO2:** To understand the kinetic molecular model of a gas, laws related to ideal gases and behaviour of real gases.
- CO3:** To explain the chemistry of liquid state and solid state and its application.
- CO4:** To classify different colloids and discuss the principles, properties and application of colloids, adsorption and adsorption isotherms.
- CO5:** 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.

NAME AND SIGNATURE:

	Departmental members	
	1.....	8.....
Chairperson /H.O.D <i>S. S. S.</i>	<i>[Signature]</i>	<i>[Signature]</i>
Subject Expert (University Nominee)	2..... <i>[Signature]</i>	9.....
Subject Expert..... <i>H. H. Akhbari</i>	3..... <i>[Signature]</i>	10.....
Representative (Industry)	4..... <i>[Signature]</i>	11..... <i>[Signature]</i>
Representative <i>B. Jais</i>	5..... <i>[Signature]</i>	12.....
Representative (Alumni)	6..... <i>[Signature]</i>	13.....
Representative <i>[Signature]</i>	7..... <i>[Signature]</i>	14.....
Representative (Professor Science Faculty Other Dept.)		<i>[Signature]</i>

B. Sc. Part - I (Old Course)
2022-23
CHEMISTRY PAPER- III
(BCH-03)
PHYSICAL CHEMISTRY

Max. Marks - 34

UNIT-1 MATHEMATICAL CONCEPTS FOR CHEMIST

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 STATE CHEMISTRY

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, Liquefaction of Gases.

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 STATE CHEMISTRY

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

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 thixotropy, Application of colloids.

Physical adsorption, chemisorption, adsorption isotherms (Langmuir and Freundlich). Nature of adsorbed state. Qualitative discussion of BET.

UNIT-IV SOLID STATE CHEMISTRY

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 pattern method. 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 state theory.

[B] CATALYSIS

Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristic of catalyst, Enzyme catalysed reactions, Micellar catalysed 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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4. 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..... <i>Asmi</i>	Departmental members:
Subject Expert..... <i>SL</i>	<i>Beel</i>
(University Nominee)	<i>SL</i>
Subject Expert..... <i>H. Mohabey</i>	<i>SL</i>
Representative.....	<i>SL</i>
(Industry)	<i>SL</i>
Representative..... <i>Bitan</i>	<i>SL</i>
(Alumni)	<i>SL</i>
Representative	<i>SL</i>
(Professor Science Faculty Other Dept.)	<i>SL</i>

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

B. Sc PART - I PRACTICAL
(Old Course)

BCHL – 01: LAB COURSE – 01

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

CO1: To understand systematic semi-micro qualitative analysis of common acidic and basic radicals.

CO2: To apply the various aspects of titration.

CO3: To learn about laboratory glass wares and apparatus and its uses.

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

CO5: To identify of functional groups in organic compounds.

NAME AND SIGNATURE:

Chairperson /H.O.D..... <i>A. S. Wani</i>	Departmental members:
Subject Expert.....	<i>Gay</i>
(University Nominee)	<i>Am</i>
Subject Expert..... <i>H. H. Mahabadi</i> <i>SH</i>	<i>Am</i>
Representative.....	<i>Am</i>
(Industry)	<i>Am</i>
Representative... <i>B. Jay</i>	<i>Am</i>
(Alumni)	<i>Am</i>
Representative <i>Am</i>	<i>Am</i>
(Professor Science Faculty Other Dept.)	<i>Am</i>

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

B. Sc PART - I PRACTICAL
(Old Course)

BCHL – 01: LAB COURSE – 01

Max. Marks - 50

The following experiments are to be conducted during the curriculum.

1. Inorganic Chemistry

[A] Semi-micro qualitative analysis (using H₂S 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 : NH₄⁺, Pb²⁺, Bi³⁺, Cu²⁺, Cd²⁺, Fe³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, Na⁺

Anions : CO₃²⁻, SO₃²⁻, SO₄²⁻, S²⁻, NO₃⁻, CH₃COO⁻, Cl⁻, Br⁻, I⁻, NO₂⁻, (Spot tests may be carried out wherever feasible)

[B] Acid-Base Titrations

1. Standardization of sodium hydroxide by oxalic acid solution.
2. Determination of strength of HCl solution using sodium hydroxide as intermediate.
3. Estimation of carbonate and hydroxide present together in mixture.
4. Estimation of carbonate and bicarbonate present together in a mixture.
5. Estimation of free alkali present in different soaps/detergents

[C] Redox Titrations

1. Standardization of KMnO₄ by oxalic acid solution.
2. Estimation of Fe(II) using standardized KMnO₄ solution.
3. Estimation of oxalic acid and sodium oxalate in a given mixture.
4. Estimation of Fe(II) with K₂Cr₂O₇ using internal (diphenylamine, anthranilic acid) as external indicator.

[D] Iodo / Iodimetric Titrations

1. Estimation of Cu(II) and K₂Cr₂O₇ using sodium thiosulphate solution iodimetrically.
2. Estimation of (a) arsenite and (b) antimony iodimetrically.
3. Estimation of available chlorine in bleaching powder iodometrically.
4. Estimation of Copper and Iron in mixture by standard solution of K₂Cr₂O₇ using sodium thiosulphate solution as titrants.

2. ORGANIC CHEMISTRY

1. Demonstration of laboratory Glasswares and Equipments.
 - Calibration of the thermometer. 80^o-82^o (Naphthalene), 113.5^o-114^o (Acetanilide), 132.5^o- 133^o (Urea), 100^o (Distilled Water).
2. Purification of organic compounds by crystallization using different solvents.
 - Phthalic acid from hot water (using fluted filter paper and stemless funnel).
 - Acetanilide from boiling water.
 - Naphthalene from methanol.
 - Benzoic acid from water.

3. Determination of the melting points of organic compounds.
Naphthalene 80° – 82° , Benzoic acid 121.5° – 122° , Urea 132.5° – 133° Succinic acid 184.5° – 185° , Cinnamic acid 132.5° – 133° , Salicylic acid 157.5° – 158° , Acetanilide 113.5° – 114° , m- Dinitrobenzene 90° , p-Dichlorobenzene 52° , Aspirin 135° .
 - Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.
 - 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 capillary method).
 - Ethanol 78° , Cyclohexane 81.4° , Toluene 110.6° , Benzene 80° .
 - i. Distillation (Demonstration)
 - Simple distillation of ethanol-water mixture using water condenser.
 - Distillation of nitrobenzene and aniline using air condenser.
 - ii. Sublimation
 - Camphor, Naphthalene, Phthalic acid and Succinic acid.
 - iii. 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 0.3 g of Congo red using 1 g of decolorizing carbon) from methanol.
5. 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.

PHYSICAL CHEMISTRY

1. Surface tension measurements.
 - Determine the surface tension by (i) drop number (ii) drop weight method.
 - Surface tension composition curve for a binary liquid mixture.
2. Viscosity measurement using Ostwald's viscometer.
 - 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 concentration of solute.
 - Viscosity Composition curve for a binary liquid mixture.
3. 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.
4. Colloids
 - To prepare colloidal solution of silver nanoparticles (reduction method) and other metal nanoparticles using capping agents.

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

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

PRACTICAL EXAMINATION

05 Hrs.

Three experiments are to be performed

M.M.50

1. Inorganic Mixture Analysis, four radicals two basic & two acid (excluding insoluble, Interfering & combination of acid radicals) OR Two Titrations (Acid-Bases, Redox and Iodo/Iodimetry) **12marks**
2. Detection of functional group in the given organic compound and determine its MPt/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, University Press.
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 Organic Chemistry, 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 8th Ed.; 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..... <i>D. S. Kher</i> Subject Expert..... (University Nominee) Subject Expert..... <i>H. N. Chhabey</i> Representative..... <i>S. J.</i> (Industry) Representative..... <i>B. Jain</i> (Alumni) Representative..... <i>Shukla</i> (Professor Science Faculty Other Dept.)	Departmental members: <i>Chauhan</i> <i>Sharma</i> <i>Sharma</i> <i>Divasta</i> <i>Sharma</i> <i>Sharma</i>
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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
2022-23
 Syllabus and Marking Scheme for B.Sc. Part II(2022-23)

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 2022-23.

NAME AND SIGNATURE:

Chairperson /H.O.D <i>A. Asthana</i>	Departmental members:
Subject Expert (University Nominee)	<i>Ceeef</i>
Subject Expert..... <i>H. Mahabey</i>	<i>As</i>
Representative..... <i>S2</i>	<i>[Signature]</i>
(Industry) <i>B. Jain</i>	<i>[Signature]</i>
Representative..... (Alumni)	<i>[Signature]</i>
Representative <i>[Signature]</i>	<i>[Signature]</i>
(Professor Science Faculty Other Dept.)	<i>[Signature]</i>

B.Sc. Part - II(CHEMISTRY)

2022-23

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 <i>Ashu</i>	Departmental members:
Subject Expert (University Nominee)	<i>Chaff</i>
Subject Expert..... <i>H. P. Arora</i>	<i>[Signature]</i>
Representative..... <i>[Signature]</i>	<i>[Signature]</i>
(Industry)	<i>[Signature]</i>
Representative..... <i>B. Jain</i>	<i>[Signature]</i>
(Alumni)	<i>[Signature]</i>
Representative <i>[Signature]</i>	<i>[Signature]</i>
(Professor Science Faculty Other Dept.)	<i>[Signature]</i>

B.Sc. Part - II(CHEMISTRY)

2022-23

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 μ_{so} (spin only) and μ_{eff} 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 6 coordination numbers. Chelates, polynuclear complexes.
- UNIT-3 COORDINATION CHEMISTRY**
Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, Crystal field splitting and stabilization energy, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). 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. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub
13. Uchchattar Akarbanic Rasayan, satya Prakash & G. D. Tuli, Shyamal Prakashan
14. Uchchattar Akarbanic Rasayan, 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 <i>A. Beni</i> Subject Expert (University Nominee) Subject Expert <i>H. Mahabey</i> Representative <i>S.S.</i> (Industry) Representative <i>B. Jai</i> (Alumni) Representative <i>Sharma</i> (Professor Science Faculty Other Dept.)	Departmental members: <i>Devi</i> <i>Sharma</i> <i>A</i> <i>Sharma</i> <i>Sharma</i> <i>Sharma</i> <i>Sharma</i>
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B. Sc. Part - II (CHEMISTRY)

2022-23

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 explain acidity of carboxylic acids based on various field effects.
- CO5:** To predict basicity and stereochemistry of amines, to illustrate synthetic transformation of aryl diazonium salts.

NAME AND SIGNATURE:

Chairperson /H.O.D <i>A. Bhu</i>	Departmental members:
Subject Expert (University Nominee)	<i>Devi</i>
Subject Expert..... <i>M. K. Bhatnagar</i>	<i>Dr. J. K. Singh</i>
Representative..... <i>W</i>	<i>Dr. A. K. Singh</i>
(Industry)	<i>Dr. S. K. Singh</i>
Representative... <i>B. J. W</i>	<i>Dr. A. K. Singh</i>
(Alumni)	<i>Dr. A. K. Singh</i>
Representative <i>S. K. Singh</i>	<i>Dr. A. K. Singh</i>
(Professor Science Faculty Other Dept.)	<i>Dr. A. K. Singh</i>
	<i>Dr. A. K. Singh</i>

B. Sc. Part - II (CHEMISTRY)

2022-23

**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-Volhard Zeilinsky 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. Carbanic Rasayan, 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 <i>AAshtane</i>	Departmental members:
Subject Expert (University Nominee)	<i>[Signature]</i> <i>[Signature]</i>
Subject Expert... <i>[Signature]</i>	<i>[Signature]</i>
Representative..... (Industry)	<i>[Signature]</i>
Representative... <i>[Signature]</i>	<i>[Signature]</i>
(Alumni)	<i>[Signature]</i>
Representative (Professor Science Faculty Other Dept.)	<i>[Signature]</i>
	<i>[Signature]</i>

B. Sc. Part - II (CHEMISTRY)

2022-23

**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 thermodynamics and 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, phase rule and Nernst distribution law and draw and interpret phase diagram and its application.
- CO5:** To differentiate between thermal and photochemical processes, explain the laws of photochemistry, low and high quantum yields, photochemical processes and reactions.

NAME AND SIGNATURE:

	Departmental members	
	1.....	8.....
Chairperson /H.O.D <i>A. Sin</i>	<i>[Signature]</i>	<i>[Signature]</i>
Subject Expert (University Nominee)	2..... <i>[Signature]</i>	9.....
Subject Expert..... <i>[Signature]</i>	3..... <i>[Signature]</i>	10.....
Representative (Industry)	4..... <i>[Signature]</i>	11..... <i>[Signature]</i>
Representative ... <i>B. Jain</i> (Alumni)	5..... <i>[Signature]</i>	12.....
Representative (Professor Science Faculty Other Dept.)	6..... <i>[Signature]</i>	13.....
	7..... <i>[Signature]</i>	14..... <i>[Signature]</i>

B. Sc. Part - II (CHEMISTRY)

2022-23

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 K_p , K_c and K_x . 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-Draper 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. Bhautik Rasayan, Puri, Sharma and Pathania, Vishal Publishing Company.
5. Bhautik Rasayan, P. L. Soni.
6. Bhautik Rasayan, 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.
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	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. P.G. Autonomous College, Durg

B.Sc. PART – I PRACTICAL
BCHL – 02 : LAB COURSE – 02

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

- CO1:** To perform the semi-micro qualitative analysis including interfering radicals and its removal.
CO2: To apply the various types of volumetric analysis.
CO3: To learn about qualitative analysis of unknown organic compounds.
CO4: To study the transition temperature of the given substance, solubility of sparingly soluble substance, the enthalpy of solution of solid, etc .
CO5: To understand principle, technique and application of paper chromatography.

NAME AND SIGNATURE:

Chairperson /H.O.D <i>A.Pu.</i>	Departmental members:
Subject Expert (University Nominee)	<i>Cest</i> <i>[Signature]</i>
Subject Expert..... <i>J. Mohabey</i>	<i>[Signature]</i>
Representative..... (Industry)	<i>[Signature]</i>
Representative..... <i>B. Jain</i>	<i>[Signature]</i>
(Alumni)	<i>[Signature]</i>
Representative (Professor Science Faculty Other Dept.)	<i>[Signature]</i>
	<i>[Signature]</i>

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-} , $\text{S}_2\text{O}_3^{2-}$, CH_3COO^- , F^- , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} , $\text{C}_2\text{O}_4^{2-}$, 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 benzylalcohol, (v) azo dye.

PHYSICAL CHEMISTRY

Transition Temperature

- Determination of the transition temperature of the given substance by thermometric/ dialometric method (e.g. $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}/\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$). 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:
 - $I_2(aq) + I^- \rightarrow I_3(aq)^{2-}$
 - $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$

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

NAME AND SIGNATURE:

Chairperson /H.O.D <i>A. Beni</i>	Departmental members:
Subject Expert (University Nominee)	<i>[Signature]</i>
Subject Expert..... <i>H. Mahabey</i>	<i>[Signature]</i>
Representative..... <i>S2</i>	<i>[Signature]</i>
(Industry)	<i>[Signature]</i>
Representative... <i>B. Jain</i>	<i>[Signature]</i>
(Alumni)	<i>[Signature]</i>
Representative <i>[Signature]</i>	<i>[Signature]</i>
(Professor Science Faculty Other Dept.)	<i>[Signature]</i>

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
2022-23
 Syllabus and Marking Scheme for B.Sc. Part III(2022-23)

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

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 2022-23.

NAME AND SIGNATURE:

Chairperson /H.O.D <i>Arshi</i>	Departmental members:
Subject Expert (University Nominee)	<i>[Signature]</i>
Subject Expert..... <i>Jyoti Chhabra</i>	<i>[Signature]</i>
Representative..... <i>[Signature]</i>	<i>[Signature]</i>
(Industry)	<i>[Signature]</i>
Representative..... <i>B. Jai</i>	<i>[Signature]</i>
(Alumni)	<i>[Signature]</i>
Representative <i>[Signature]</i>	<i>[Signature]</i>
(Professor Science Faculty Other Dept.)	<i>[Signature]</i>

B. Sc. Part - III (CHEMISTRY)
2022-23
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 explain magnetic properties of complexes and interpret spectra of transition metal complexes.
CO3: To understand nomenclature, classification, structure and properties of organometallics.
CO4: To understand trace and essential elements in biological process structure and mechanism of hemoglobin.
CO5: To understand role of hard and soft acids and bases, biopolymers in chemistry and their structure.

NAME AND SIGNATURE:

		Departmental members	
Chairperson /H.O.D	<i>A. Beni</i>		
Subject Expert		1.....	8.....
(University Nominee)		2.....	9.....
Subject Expert.....	<i>M. Mahabey</i>	3.....	10.....
	<i>Q</i>	4.....	11.....
Representative		5.....	12.....
(Industry)		6.....	13.....
Representative	<i>B. Jain</i>	7.....	14.....
(Alumni)			<i>am</i>
Representative	<i>S. K. S.</i>		
(Professor Science Faculty Other Dept.)			

B.Sc. Part - III(CHEMISTRY)

2022-23

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 μ_{so} (spin only) 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, 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. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub.
13. Uchchattar Akarbanic Rasayan, satya Prakash & G. D. Tuli, Shyamal Prakashan.
14. Uchchattar Akarbanic Rasayan, Puri & Sharma.
15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand

B. Sc. Part - III (CHEMISTRY)
2022-23
PAPER- II (BCH – 08)
ORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, students would be able:

CO1: To classify heterocyclic compounds and explain its structure, synthesis and reaction mechanisms.

CO2: To discuss the concept, structure, formation of organometallic reagents and synthetic applications of enolates.

CO3: To categorize and name various biomolecules and explain their structures and properties.

CO4: To describe various polymers and polymerization mechanism, classify synthetic dyes and discuss their chemistry.

CO5: To explain basic principles of UV-Visible, IR and Mass spectroscopy, and their applications, the magnetic properties of atomic nucleus and resonance and interpretation of NMR spectra.

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D <i>Arshi</i>		
Subject Expert (University Nominee)	1. <i>[Signature]</i>	8. <i>[Signature]</i>
Subject Expert..... <i>H. Mahabey</i>	2. <i>[Signature]</i>	9.
..... <i>[Signature]</i>	3. <i>[Signature]</i>	10.
Representative (Industry)	4. <i>[Signature]</i>	11. <i>[Signature]</i>
.....	5. <i>[Signature]</i>	12.
Representative <i>B. Jain</i>	6. <i>[Signature]</i>	13.
(Alumni)	7. <i>[Signature]</i>	14.
..... <i>[Signature]</i>		
Representative (Professor Science Faculty Other Dept.)		<i>[Signature]</i>

B.Sc. Part - III(CHEMISTRY)

2022-23

**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**A.ORGANOMETALLIC 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. Robinson 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}C MR 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 India Edition, 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.

B. Sc. III (CHEMISTRY)
2022-23
PAPER- III (BCH-09)
PHYSICALCHEMISTRY

Course Outcome (CO):

After completion of the course, the students will be able

- CO1:** To explain the fundamentals/concepts/principles/postulates of quantum mechanics, Schrodinger wave equation and its applications.
- CO2:** To compare the basic ideas of Valence Bond Theory and Molecular Orbital Theory and apply LCAO method, coefficients of hybrid orbitals and Huckel MOT and its application
- CO3:** To describe the fundamentals and application of electromagnetic spectrum, microwave, infrared, Raman, electronic spectroscopy.
- CO4:** To discuss the principles and applications in electrochemistry.
- CO5:** To illustrate electrochemical cell and its applications, analyze problems and apply the principles/concepts in finding their solutions.

NAME AND SIGNATURE:

		Departmental members	
Chairperson /H.O.D	<i>Ashu</i>		
Subject Expert (University Nominee)		1..... <i>[Signature]</i>	8..... <i>[Signature]</i>
Subject Expert.....	<i>H. Mahabey</i>	2..... <i>[Signature]</i>	9.....
Representative (Industry)	<i>[Signature]</i> <i>SL</i>	3..... <i>[Signature]</i>	10.....
Representative (Alumni)	<i>B. Jais</i>	4..... <i>[Signature]</i>	11..... <i>[Signature]</i>
Representative (Professor Science Faculty Other Dept.)	<i>[Signature]</i>	5..... <i>[Signature]</i>	12.....
		6..... <i>[Signature]</i>	13.....
		7..... <i>[Signature]</i>	14..... <i>[Signature]</i>

B.Sc. Part - III(CHEMISTRY)

2022-23

PAPER- III (BCH - 09) PHYSICAL CHEMISTRY

Max Marks 34

UNIT-1

QUANTUM MECHANICS-I

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.

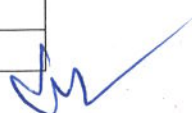
REFERENCE BOOK

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 Eastn.
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. Bhoutic Rasayan, Puri & Sharma.
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

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 <i>Aswini</i>	Departmental members:
Subject Expert (University Nominee)	<i>dy</i>
Subject Expert <i>Dr. H. Mahabadi</i>	<i>Dr. Mahabadi</i>
Representative <i>SH</i> (Industry)	<i>SH</i>
Representative <i>B. Jain</i> (Alumni)	<i>B. Jain</i>
Representative <i>Sharma</i> (Professor Science Faculty Other Dept.)	<i>Sharma</i>
	<i>Divaster</i>
	<i>Divaster</i>
	<i>Divaster</i>

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

B.Sc. Part- III PRACTICAL
BCHL-03: LAB COURSE -03

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 the application of Lambert-Beer's law, Kohlrausch law, colligative property etc using instruments/apparatus.

Name and Signatures

Chairperson /H.O.D <i>Asen</i>	Departmental members:
Subject Expert (University Nominee)	<i>Asen</i>
Subject Expert..... <i>Mishra</i>	<i>Asen</i>
Representative..... (Industry)	<i>Asen</i>
Representative... <i>B. Jain</i> (Alumni)	<i>Asen</i>
Representative (Professor Science Faculty Other Dept.)	<i>Asen</i>

Asen

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

B.Sc. Part- IIPRACTICAL
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 Fe₂O₃ by precipitating iron as Fe(OH)₃.
- Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)₃ (aluminium oxinate).
- Estimation of Barium as BaSO₄

Inorganic Preparations:

- Tetraamminecopper (II) sulphate, [Cu(NH₃)₄]SO₄.H₂O
- Cis and trans K[Cr(C₂O₄)₂. (H₂O)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)
- Benzoylation 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.
- Benzylisothiuronium 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 potentiometric 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 pK_a of monobasic acid

UV/ Visible spectroscopy









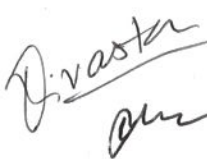

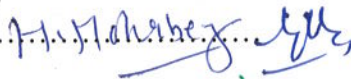

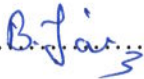

1. Verify Lambert-Beer's law and determine the concentration of $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration.
2. Determine the concentrations of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ in a mixture.
3. Study the kinetics of iodination of propanone in acidic medium.
4. Determine the amount of iron present in a sample using 1,10-phenanthroline.
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, acetaldehyde, acetic acid, etc.) in water.
9. Absorption spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ (in 0.1 M H_2SO_4) and determine ϵ_{max} values.

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

Reference books

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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.

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.)	

