

Chaudhary Ranbir Singh University, Jind

Revised Scheme of Examination for the Chemistry Subject in Under Graduate Programmes

As per NEP 2020 Curriculum and Credit Framework for Undergraduate Programmes

(Multiple Entry- Exit, Internships and Choice Based Credit System LOCF) with effect from the session 2023-24 (in phased manner)

Semester	Course Type	Applicable Scheme	Course Code	Nomenclature of course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
					Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
1	CC-1	Scheme A	B-23-CHE-101	Chemistry-I	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M1	Scheme A & D	B-23-CHE-102	Minor Chemistry-I	2	1	1	1	2	3	10	5	20	15	50	3	3
	MDC-1	Scheme A & D	B-23-CHE-103	Introductory Chemistry-I	3	2	1	2	2	4	15	5	35	20	75	3	3
2	CC-2	Scheme A	B23-CHE-201	Chemistry-II	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M2	Scheme A & D	B23-CHE-202	Minor Chemistry-II	2	1	1	1	2	3	10	5	20	15	50	3	3


 Anshul Kumar
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	MDC-2	Scheme A & D	B- 23- CHE -203	Introductory Chemistry-II	3	2	1	2	2	4	15	5	35	20	75	3	3
Internship of 4 credits of 4-6 weeks duration after 2 nd Semester																	
3	CC-3	Scheme A	B- 23- CHE -301	Chemistry-III	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M3	Scheme A & D	B- 23- CHE -301	Chemistry-III	4	3	1	3	2	5	20	10	50	20	100	3	3
	MDC-3	Scheme A & D	B23- CHE -302	Introductory Chemistry-III	3	2	1	2	2	4	15	5	35	20	75	3	3
4	CC-4	Scheme A	B- 23- CHE -401	Chemistry-IV	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC- M4(V)	Scheme A	From The Available pool of Vocational courses of 4 credits of University as per NEP		4	3	1	3	2	5	20	10	50	20	100	3	3
Internship of 4 credits of 4-6 weeks duration after 4th Semester (if not done after second semester)																	

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5	CC-5	Scheme A	B23-CHE-501	Chemistry-V	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M5(V)	Scheme A	From The Available pool of Vocational courses of 4 credits of University as per NEP		4	3	1	3	2	5	20	10	50	20	100	3	3
6	CC-6	Scheme A	23-CHE-601	Chemistry-VI	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M6(V)	Scheme A	From The Available pool of Vocational courses of 4 credits of University as per NEP		4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M7(V)	Scheme A	From The Available pool of Vocational courses of 4 credits of University as per NEP		4	3	1	3	2	5	20	10	50	20	100	3	3

Note: Four Credits of Internship Earned By a Student during Summer Internship after 2nd Semester or 4th Semester Will Be Taken Into Account In Fifth Semester of a Student Who Pursue 3 Year UG Programme Without Taking Exit Option

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Coursecomposition-Theory/Theory+Tutorial					
Course Credit	InternalAssessmentmarks		Endtermexammarks	Totalmarks	
2	15		35	50	
3	25		50	75	
4	30		70	100	
Coursecomposition-Theory+Practical					
Course Credit	Theory		Practical		Totalmarks
Theory+Practical	InternalAssessmentmarks	Endtermexammarks	InternalAssessmentmarks	Endtermexammarks	
1+1	10	20	5	15	50
2+1	15	35	5	20	75
2+2	15	35	15	35	100
3+1	20	50	10	20	100
0+4	NA	NA	30	70	100

1. Internal assessment(30%) shall be broadly based on the following defined components of;

- Class participation
- Seminar/Presentation/Assignment/Quiz/class test, etc.
- Mid Term Exam

Total Internal Assessment Marks(Theory)	Class Participation	Seminar/Presentation/Assignment/Quiz/class test, etc.	Mid-Term Exam
10	4	-	6
15	4	4	7
20	5	5	10
25	5	7	13
30	5	10	15

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Total Internal Assessment Marks (Practicum)	Class Participation	Seminar/Demonstration/Viva-Voce/Lab record, etc.	Mid-Term Exam
5		5	NA
10		10	NA
15	5	10	NA
30	5	10	15

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COURSE TYPE: CC-1

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	I		
Name of the Course	Chemistry-I		
Course Code	B-23-CHE-101		
Course Type: (CC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Enable to understand the basis of quantum mechanics and structural idea and relevance in describing shapes of s, p and d orbitals. 2. To learn about role of temperature and pressure to establish the state of gases and describe the concept of critical constants of real gases. 3. Get knowledge about the electrophile/nucleophile and its role in mechanism of preparation of organic compounds. 4. To know the physical properties, morphology and crystalline study of liquid and different type of solids. 5*. Hand on practice in preparation of solutions, compounds, estimation and determination of physical properties of some compounds.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks:70+30* Internal Assessment Marks:20+10* End Term Exam Marks:50+20*		Time:03 + 03*	



Part B- Contents of the Course

Instructions for Paper- Setter

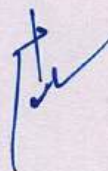
Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type). All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics
I	Atomic Structure Contact Hours 12 Dual behaviour of matter and radiation, de Broglie's relation, Heisenberg's uncertainty principle, concept of atomic orbitals, significance of quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ^2, shapes of s, p, d, f orbitals, Rules for filling electrons in various orbitals, effective nuclear charge, Slater's rules. Periodic table and atomic properties Classification of periodic table, definition of atomic and ionic radii, ionisation energy, electron affinity and electronegativity, trend in periodic table (in s and p-block elements), Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale, Sanderson's electron density ratio.
II	Gaseous State Contact Hours 11 Kinetic theory of gases, Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity, and most Probable velocity. Collision diameter, collision number, collision frequency and mean free path (Derivations excluded), Deviation of Real gases from ideal behaviour, Derivation of Van der Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Critical Phenomenon Concept of Critical temperature, critical pressure, critical volume, relationship Between critical constants and Van der Waal's constants (Derivation excluded).
III	Structure and Bonding Contact Hours 11 Localized and delocalized chemical bond, Van der Waals interactions. Concept of resonance and its applications, hyperconjugation, inductive effect, Electromeric effect and their comparison.

Recommended Books/e-resources/LMS:

1. Lee, J.D.; (2010), **Concise Inorganic Chemistry**, Wiley India.
2. Kapoor, K.L. (2015), **a Textbook of Physical Chemistry**, Vol 1, 6 th Edition, McGraw Hill Education.
3. Clayden, J.; Greeves, N.; Warren, S. (2012), **Organic Chemistry**, Oxford.
4. Morrison, R. N.; Boyd, R. N. **Organic Chemistry**, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), **Senior Practical Physical Chemistry**, R. Chand & Co, New Delhi.
6. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), **Vogel's Textbook of Quantitative Chemical Analysis**, John Wiley and Sons.

*Applicable for courses having practical component.



COURSE TYPE: MDC-1

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	I		
Name of the Course	Introductory Chemistry-I		
Course Code	B-23-CHE-103		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	MDC		
Level of the course (As per Annexure-I)	0-99		
Pre-requisite for the course (if any)	Higher secondary other than science discipline		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. To get knowledge about structure and bonding. 2. To learn about hydrocarbons and their applications. 3. To get aware about different polymers. 4. To get knowledge about preservative. 5* To get knowledge about experiments related to daily life.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks:50+25* Internal Assessment Marks:15+5* End Term Exam Marks: 35+20*		Time:03 + 03 hrs	



Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics
I	Atomic Structure and Bonding Contact Hours 8 Introduction, Elementary introduction of atomic structure and chemical bonding, Representation of elements/ atoms, Lewis structure, electronic configurations (1-30)
II	Carbon and Its Compounds Contact Hours 8 Introduction, Tetravalency of Carbon, allotropes of carbon and their properties, hydrocarbons (1-5), nomenclature (linear compounds), Applications of hydrocarbons.
III	Polymers Contact Hours 7 Introduction, elementary idea of synthetic and natural polymers, Homo polymers and copolymers, uses and properties (Natural rubber, Vulcanized rubber, Polyethene, PVC, Styrene, Teflon, PAN, Nylon-66)
IV	Food Preservatives Contact Hours 7 Elementary idea of natural and synthetic food preservatives, rancidity, uses and properties, different food preservation processes (pickle, Jam), artificial sweeteners, uses and properties
V*	Practicals: Contact Hours 30 1. Identify the pH of the given samples through pH strip. 2. Experiments related to preserving food items. 3. Preparation of Artificial Silk. 4. To synthesize some polymers as per available resources.

Suggested Evaluation Methods	
Internal Assessment: 15+5* > Theory • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	End Term Examination: 35+20*
Part C-Learning Resources	
Recommended Books/e-resources/LMS: 1. Dhawan S.N., Organic Chemistry, Vol 1 Pardeep Publication. 2. Subbulakshmi G, Food processing and preservation, New Age International Publishers. 3. Manas Chanda, 2013, Introduction to Polymer Science and Chemistry 2nd Edition, Making Rayon Fiber - Artificial silk, chemical experiment! How to make silk from cotton wool ("Artificial silk" experiment) Neelam Seedher, Basic Concepts: Physical Chemistry Experiments, Kindley Edition	

*Applicable for courses having practical component.

COURSE TYPE: CC-2

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	II		
Name of the Course	Chemistry-II		
Course Code	B-23-CHE-201		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Able to understand the theories which governs the shape, structure and ionic behavior, polarizability, ionic structures and concept of Lattice energy of crystals of molecules. 2. To know the basics of rates of chemical reactions ,the laws and solubility behavior of solutes in different compositions of solvents 3. To know about alkanes, alkene, cycloalkanes and their chemical reactions. 4. To understand about weak interactions and bonding in metals. 5*. Hand on practice for estimation and determination of viscosity, specific refractivity properties of some compounds.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks:70+30* Internal Assessment Marks:20+10* End Term Exam Marks: 50+20*		Time:03+03*	

Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics
I	Covalent Bond Contact Hours 11 Valence bond theory approach, shapes of simple inorganic molecules and ions based on valence shell electron pair repulsion (VSEPR) theory and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Molecular orbital theory of homonuclear (N_2, O_2) and heteronuclear (CO and NO) diatomic molecules, dipole moment and percentage ionic character in covalent bond. Ionic Solids Ionic structures (NaCl, CsCl, ZnS (Zinc blende), CaF_2) size effects, radius ratio rule and its limitations, Concept of Lattice energy, Born- Haber cycle, Solvation energy and its relationship with solubility of Ionic solids, Polarizing power and Polarisability of ions, Fajan's rule.
II	Chemical Kinetics Contact Hours 12 Concept of reaction rates, rate equation, factors influencing the rate of reaction, Order and molecularity of a reaction, integrated rate expression for zero, first, Half-life period of a reaction, Arrhenius equation. Distribution Law Nernst distribution law – its thermodynamic derivation, Nernst distribution law after association and dissociation of solute in one of the phases, of distribution law: (i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride
III	Alkanes and Cycloalkanes Contact Hours 11 Nomenclature, classification of carbon atoms in alkanes and its structure. Isomerism in alkanes, sources. Methods of formation: Wurtz reaction, Kolbe reaction, Corey- House reaction and decarboxylation of carboxylic acids, physical properties. Mechanism of free radical halogenation of alkanes: reactivity and selectivity. Nomenclature of Cycloalkanes, Baeyer's strain theory and its limitations, theory of strainless rings.

Part C-Learning Resources

Recommended Books/e-resources/LMS:

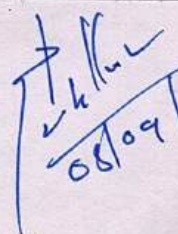
1. Lee, J.D.; (2010), **Concise Inorganic Chemistry**, Wiley India.
2. Kapoor, K.L. (2015), **A Textbook of Physical Chemistry**, Vol 1, 6 th Edition, McGraw Hill Education.
3. Clayden, J.; Greeves, N.; Warren, S. (2012), **Organic Chemistry**, Oxford.
4. Morrison, R. N.; Boyd, R. N. **Organic Chemistry**, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), **Senior Practical Physical Chemistry**, R. Chand &Co, New Delhi.
6. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), **Vogel's Textbook of Quantitative Chemical Analysis**, John Wiley and Sons.

*Applicable for courses having practical component.



CC-MI

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	I		
Name of the Course	Minor Chemistry-I		
Course Code	B-23-CHE-102		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. To understand the basics of Covalent bonding in simple molecules. 2. To get the basics of rates of chemical reactions and factors affecting it. 3. To learn about the nomenclature, classification and methods of preparation of alkenes. 4. To learn about qualitative knowledge of conductors, semiconductors and insulates. 5*. Hand on practice in preparation of solutions, compounds, estimation and determination of physical properties of some compounds.		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	15	30	45
Max. Marks:30 + 20* Internal Assessment Marks:10 + 05* End Term Exam Marks: 20 + 15*		Time: 03+ 03* hrs	


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Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics
I	Covalent Bond Contact Hours 4 Shapes of simple inorganic molecules and ions based on valence shell electron pair repulsion (VSEPR) theory and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral arrangements.
II	Chemical Kinetics Contact Hours 4 Concept of reaction rates, factors influencing the rate of reaction, Order and molecularity of a reaction, integrated rate expression for zero and first order reactions.
III	Alkanes (upto 5 carbon atoms) Contact Hours 4 Alkanes, nomenclature, classification of carbon atoms in alkanes. Isomerism in alkanes, methods of formation: Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids.
IV	Metallic Bond and semiconductors Contact Hours 3 Metallic bond – Qualitative idea of Band theory of metallic bond (conductors, semiconductors, insulators).
V	Contact Hours 30 1. To determine the melting point of given organic compound. 2. To prepare a pure sample of dibenzalacetone from benzaldehyde. 3. Acid/Base Titration: Determination of strength of HCl using NaOH. 4. To determine the refractive index of given liquid. 5. To study the process of sublimation of camphor or phthalic acid.

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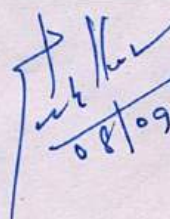
Suggested Evaluation Methods	
Internal Assessment: 10 + 05* > Theory • Class Participation: 3 • Seminar/presentation/assignment/quiz/class test etc.: 3 • Mid-Term Exam: 4 > Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 05 • Mid-Term Exam: NA	End Term Examination: 20 + 15*
Part C-Learning Resources	
Recommended Books/e-resources/LMS: 1. Dhawan S.N., Organic Chemistry, Vol 1 Pardeep Publication. 2. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 1, 6th Edition, McGrawHill Education. 3. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi. 4. Lee, J.D.; (2010), Concise Inorganic Chemistry, Wiley India.	

*Applicable for courses having practical component.

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CC-M2

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	II		
Name of the Course	Minor Chemistry-II		
Course Code	B-23-CHE-202		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. To know the basics of periodic properties and hybridization. 2. To learn about the ionic solids. 3. Understand about the semiconductors and metallic bonds. 4. Get the knowledge of stereochemistry of simple organic molecules. 5*. Hand on practice in preparation of solutions, compounds, estimation and determination of physical properties of some compounds.		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	15	30	45
Max. Marks:30 + 20* Internal Assessment Marks:10 + 05* End Term Exam Marks: 20 + 15*		Time:03+ 03* hrs	


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Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics
I	Periodic table and atomic properties Contact Hours 4 Atomic properties: atomic and ionic radii, ionisation energy, electron affinity and electronegativity definition, trend in periodic table, effective nuclear charge, Slater's rules.
II	Ionic Solids: Contact Hours 4 Stoichiometric and Non-stoichiometric defects in crystals, Lattice energy and Born-Haber cycle, Solvation energy and its relationship with solubility of Ionic solids, Polarizing power and Polarisability of ions, Fajan's rule.
III	Structure and Bonding in Organic Compounds Contact Hours 4 Localized and delocalized chemical bond, Van der Waal's interactions, resonance: conditions and resonance effect, hyperconjugation, inductive effect, Electromeric effect & their comparison.
IV	Gaseous State Contact Hours 3 Kinetic theory of gases, Calculation of root mean square velocity, average velocity, and most probable velocity. Collision diameter, collision number, collision frequency and mean free path (derivations excluded).
V*	Contact Hours 30 1. Acid/Base titration: Determination of strength of oxalic acid using NaOH. 2. Redox titrations: Determination of Fe^{2+} ions using KMnO_4 . 3. To determine the surface tension of given liquid using stalagmometer by drop no. method. 4. To prepare a sample of iodoform.

Suggested Evaluation Methods	
Internal Assessment: 10 + 05* ➤ Theory • Class Participation: 3 • Seminar/presentation/assignment/quiz/class test etc.: 3 • Mid-Term Exam: 4 ➤ Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 05* • Mid-Term Exam: NA	End Term Examination: 20 + 15*
Part C-Learning Resources	
Recommended Books/e-resources/LMS: 1. Huheey, J.E.; Keiter, E.A.; Keiter, R. L.; Medhi, O.K. (2009), Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education. 3. Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, Oxford University Press. 4. Kapoor, K.L.(2015), A Textbook of Physical Chemistry, Vol 1, 6th Edition, McGraw Hill Education. 5. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.	

*Applicable for courses having practical component.

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COURSE TYPE: MDC-2

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	II		
Name of the Course	Introductory Chemistry-II		
Course Code	B-23-CHE-203		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	MDC		
Level of the course (As per Annexure-I)	0-99		
Pre-requisite for the course (if any)	Higher secondary other than science discipline		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. To learn about role of Indian scientists in the upliftment of research 2.To learn about classification of elements with their properties 3.To learn about three states of matter 4.To get more knowledge about role of fertilizers in fertility of soil 5*.To learn about acid- base reaction in daily life		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks:50+25* Internal Assessment Marks:15+5* End Term Exam Marks:35+20*		Time:03+03*	

Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics
I	Renowned Indian Scientists Contact Hours 8 Brief Biography of Renowned Indian Scientists (Hargobind Khurana, Dr. P.C. Ray, Sir C.V. Raman, Dr. A.P.J. Abdul Kalam, C. N. R. Rao, Dr. Vikram Sara Bhai, Dr. Homi Jahangir Bhabha, Dr. J.C. Bose, Dr. S. N. Bose)
II	Metal and Non-Metals Contact Hours 8 Periodic table, classification of elements, physical and chemical aspects of metals and non-metals, Ore and Minerals of Iron, Copper, Aluminium, alloys
III	Physical Properties of Matter Contact Hours 7 Classification of matter, properties, uses, ideal gas equation, real gas equation, some important compounds (baking soda, washing soda, plaster of Paris, gypsum,, glass)
IV	Soil and fertilizers Contact Hours 7 Green revolution, soil: types of soil and their components for fertility, grow condition, pH, irrigation, biofertilizers, chemical fertilizers and their uses, acid rain.
V*	Practicals: Contact Hours 30 1. To prepare Plaster of Paris 2. To prepare Potash Alum 3. To study the effect of acid on Baking and washing soda 4. To perform the action of water on quick lime and identify the nature of reaction (Exo/Endothermic)

Suggested Evaluation Methods

Internal Assessment: 15+5***Theory**

- Class Participation: 4
- Seminar/presentation/assignment/quiz/class test etc.: 4
- Mid-Term Exam: 7

Practicum

- Class Participation: NA
- Seminar/Demonstration/Viva-voce/Lab records etc.: 5
- Mid-Term Exam: NA

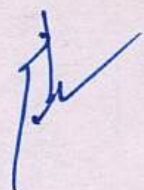
End Term Examination:**35+20***

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Chemistry In Daily Life : Third Edition by Kirpal Singh , PHI Learning
2. General Chemistry: Principles, Patterns, and Applications, Bruce Averill, Strategic Energy Security Solution, Patricia Eldredge, R.H. Hand, LLC, Copyright Year: 2011
3. The Great Indian Scientists Paperback – 1 January 2017, Cengage Learning India

*Applicable for courses having practical component.



Part A - Introduction

Subject	Chemistry		
Semester	III		
Name of the Course	Chemistry-III		
Course Code	B-23-CHE-301		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1.To learn about the structure of S and P-block elements, their properties and discuss their use in daily life as well as industrial applications. 2.To understand about various laws and theories related to eletrochemistry-I and know about their thermodynamic properties. 3.To understand about variation of conductance studies with concentration and explain with many phenomenon. 4.The fundamental properties, structures and reactivity of organic compounds such alkene,alkyne arenes,alkyl and aryl halide etc. 5.* Learning about reaction mechanism and predict the outcome of the reactions. 6. How to distinguish between the organic compounds by use of different chemical tests.		
Credits	Theory	Practical	Total
	3	1	4

Contact Hours	45	30	75
Max. Marks:70+30* Internal Assessment Marks:20+10* End Term Exam Marks: 50+20*		Time:03+03*	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.			
Unit	Topics & Contact Hours		
I	s and p-Block Elements 11hours Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded). Structure, preparation and properties of Diborane and Borazine. Catenation, carbides, fluorocarbons, silicates (structural aspects), structure of oxides of Nitrogen and Phosphorous, structure of white and red phosphorus. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine and comparison of acidic strength of oxyacids. low chemical reactivity of noble gases, chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon.		
II	Electrochemistry-I 11hours Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution (Numericals) Concepts of pH and pK _a , Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action. Electrochemistry-II Reversible & irreversible cells, Calculation of thermodynamic quantities of cell reaction (ΔG , ΔH & K). Types of reversible electrodes – metal- metal ion, gas electrode, metal – insoluble salt-anion and redox electrodes. Nernst equation, Standard Hydrogen electrode, reference electrodes, Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode.		
III	Alkynes 11hours Nomenclature and its structure. Methods of formation: using Calcium carbide,dehydrohalogenation, Kolbe's electrolysis. Chemical reactions: Mechanism of electrophilic and nucleophilic addition reactions, formation of metal acetylides,		

	addition of bromine and alkaline KMnO_4, ozonolysis. Acidity of alkynes. Stereochemistry of Organic Compounds Concept of isomerism: Structural and Stereoisomerism. Symmetry elements, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules (up-to 2 asymmetric centres), diastereomers, threo- and erythro- nomenclature, meso-compounds, Relative and absolute configuration, sequence rules, R and S system of nomenclature. Cis- Trans isomerism, E & Z system of nomenclature, Conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, Newman and Sawhorse projection formulae.
IV	Benzene and its derivatives: 12 hours Nomenclature, Aromatic nucleus and side chain, Huckels' rule of aromaticity. Aromatic electrophilic substitution, mechanism of nitration, halogenation, sulphonation, and Friedel- Crafts reaction. Energy profile diagrams. Activating, deactivating substituents and orientation. Alkyl halides: Nomenclature, methods of formation: from alkenes and alcohol, nucleophilic substitution reactions of alkyl halides, $\text{S}_\text{N}2$ and $\text{S}_\text{N}1$ reactions with energy profile diagrams. Aryl halides: Methods of formation: halogenation, Sandmeyer reaction. The addition-elimination, and the elimination- addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl, and aryl halides.
V*	30 hours Gravimetric Analysis: Estimation of Ni^{2+} as Ni-dimethylglyoxime and Al^{3+} as Al-oxinate. Colorimetry: To verify Beer-Lambert law for $\text{KMnO}_4 / \text{K}_2\text{Cr}_2\text{O}_7$ and determine the unknown concentration of the given solution of $\text{KMnO}_4 / \text{K}_2\text{Cr}_2\text{O}_7$ solution. - To prepare acidic and basic buffer solutions of pH 5 and 9 respectively. - Preparation of Cuprous chloride, tetra ammine cupric sulphate. - To determine the CST of phenol-water system. - To determine the solubility of Benzoic acid at various temperatures and to determine the ΔH of the dissolution process. - To determine the Enthalpy of neutralisation of strong base Vs strong acid and weak acid/weak base Vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base - Determine the rate constant of hydrolysis of ethyl acetate.
Suggested Evaluation Methods	

MDC-3

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	III		
Name of the Course	Introductory Chemistry-III		
Course Code	B-23-CHE-302		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course (As per Annexure-I)	0-99		
Pre-requisite for the course (if any)	Higher secondary other than science discipline		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. To learn about different energy resources. 2. To learn about the purification process of water quality 3. To Know more about Pesticides and their bad impacts on health 4. To get more knowledge on the impacts of pollution on environment 5*. To get acquaint about the pH of different food items.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks:50+25* Internal Assessment Marks:15+5* End Term Exam Marks: 35+20*		Time:03+03*	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all			

selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics&Contact Hours
I	8 hours Pollution and their types: Plastic and polyethene pollution, pollution sources, Recycling of plastic, greenhouse effect, ozone depletion
II	8 hours Energy: Energy sources, renewable and non-renewable sources, cells and batteries, fuel cell, solar cell, polymer cell
III	7hours Water: Sources of drinking water and uses, water conservation, Permissible TDS, Techniques of purification of water, R.O. water purification process (Osmosis and Reverse Osmosis), wastewater management
IV	7hours Pesticides and Herbicides: General introduction and definition, biological control and chemical control: natural and synthetic pesticides, benefits and adverse effects of DDT, BHC, malathion.
V*	30hours Practicals: 1. To check the TDS of different samples of water. 2. Purify the given sample of water using different purification techniques. 3. Identify the pH of different samples of food items. 4. Neutralize the given samples of base using acids

30

Suggested Evaluation Methods

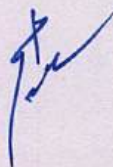
Internal Assessment: 15 + 5* Theory • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	End Term Examination: 35+20*
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. **Zero Waste: Management Practices for Environmental Sustainability** by Ashok K. Rathoure
2. **Sustainable Solid Waste Management** by Ni-Bin Chang
3. **Handbook of Advanced Industrial and Hazardous Wastes Treatment** by Lawrence K. Wang (Editor); Nazih K. Shammass (Editor); Yung Tse Hung (Editor)
4. **Pesticides and Insecticides, Development and Use**, Bobby Jones|2018
5. **WATER TREATMENT, How To Make Water Safe To Drink**, David Holman
6. **Energy, A Beginner's Guide**, Vaclav Smil, 2017
7. **Advanced Physical Chemistry, Practical Handbook**, Gurdeep Raj, Edition (2016)
8. **Advanced Practical Physical Chemistry, Handbook**, J.B. Yadav, Edition (2016)
9. **Goyal, P K, Water Pollution Causes, Effects and Control** New age International Publishers

***Applicable for courses having practical component.**



CC-4

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	IV		
Name of the Course	Chemistry-IV		
Course Code	B-23-CHE-401		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Classify d block and f block elements and also know their properties 2. Learn about the basic idea of analysis with respect to qualitative as well as quantitative measures 3. Know about the first and second law of thermodynamics and also their implications and also know about the concept of chemical equilibrium 4. Know about the alcohols, phenols, aldehydes and ketones with respect to their general characteristics and their important reactions 5*. To get knowledge about identification and confirmation of acidic and basic radicals in a given inorganic salts/mixtures		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks:70+30* Internal Assessment Marks:20+10* End Term Exam Marks: 50+20*		Time:03+03*	

Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics&Contact Hours
I	Chemistry of d-Block elements 12hours Definition of transition elements, General characteristic properties of d-Block elements, Comparison of ionic radii 3d, 4d and 5d series elements, magnetic properties, Stability of various oxidation states and Latimer and Frost diagrams, Structure of some compounds of transition elements- TiO_2 , VOCl_2 , FeCl_3 , CuCl_2 and $\text{Ni}(\text{CO})_4$. Chemistry of f-Block elements Lanthanide contraction, oxidation states, magnetic properties, complex formation, colour and ionic radii. Actinides: General characteristics of actinides, Transuranic elements, comparison of properties of Lanthanides and actinides with transition elements.
II	Theory of Qualitative and Quantitative Analysis 11hours Chemistry of analysis of various groups of basic and acidic radicals, chemistry of identification of acid radicals in typical combination, common ion effect, solubility product, theory of precipitation, co-precipitation, post precipitation, purification of precipitates.
III	Thermodynamics-I 11hours First law of thermodynamics: statement, concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule– Thomson coefficient for ideal gas and real gas and inversion temperature. Calculation of w , q , dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Second law of thermodynamics, Carnot cycles and its efficiency, Concept of entropy, entropy as a function of V & T , entropy as a function of P & T . Chemical Equilibrium Concept of Equilibrium constant, Temperature dependence of equilibrium constant, Clausius–Clapeyron equation and its applications.
IV	Alcohols 11hours Monohyric alcohols: nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids, and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols. Phenols Nomenclature, structure, and bonding. Preparation: Cumene hydroperoxide method, from diazonium salts, physical properties, and acidic character. Chemical Reactions: — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen

	rearrangement, Reimer-Tiemann reaction, Kolbe's reaction. Aldehydes and Ketones Nomenclature and structure of the carbonyl group. Preparation: oxidation of alcohols, from acid chlorides and from nitriles, Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group: benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmenson and Wolff-Kishner reductions.
V*	30hours Practicals: 1. To prepare salicylic acid from Aspirin. 2. To prepare m-nitroaniline from m-dinitrobenzene. 3. Semimicro qualitative analysis of mixture containing not more than four radicals (excluding interfering, Combinations and insoluble): Pb^{2+}, Cu^{2+}, Fe^{3+}, Ni^{2+}, Ca^{2+}, NH_4^+, CO_3^{2-}, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, PO_4^{3-}, SO_4^{2-}
Suggested Evaluation Methods	
Internal Assessment: 20+10* Theory • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	End Term Examination: 50+20*
Part C-Learning Resources	
Recommended Books/e-resources/LMS: 1. Huheey, J.E.; Keiter, E.A.; Keiter, R. L.; Medhi, O.K. (2009), Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education. 2. Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, Oxford University Press. 3. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 1, 6th Edition, McGraw Hill Education. 4. Clayden, J.; Greeves, N.; Warren, S. (2012), Organic Chemistry, Oxford. 5. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 6. Nasipuri, D. (2018), Stereochemistry of Organic Compounds: Principles and Applications, 3rd Edition, New Age International. 7. Gunstone, F. D. (1975), Guidebook to Stereochemistry, Prentice Hall Press.	

*Applicable for courses having practical component.

CC-5

Session 2023-24			
Part A- Introduction			
Subject	Chemistry		
Semester	V		
Name of Course	Chemistry-V		
Course Code	B-23 CHE-501		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of Course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Enable to understand the basis of coordination chemistry of complexes. 2. To learn about role of thermodynamics and equilibrium in predicting various physical properties of systems. 3. Get knowledge about the quantum mechanical properties and analysis of diatomic molecules by spectroscopy. 4. To understand the synthesis and mechanism of some organic reactions and heterocyclic compounds. 5*. Hand on practice in preparation of metal complexes, identification of organic and measurement of surface tension of solutions.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max marks:70+30*	Examination Time: 03+03* Hours		
Internal Assessment Marks:20+10*			
End Term Exam Marks:50+20*			
Part B- Contents of the Course			

Instructions for Paper-Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1) based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

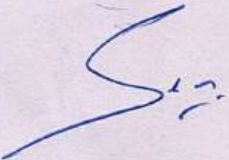
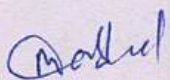
Unit	Topics	Contact Hours
I	Coordination Compounds: Werner's theory of coordination compounds, EAN, chelates, nomenclature of coordination compounds, isomerism in coordination compounds. Metal Ligand Bonding in Transition Metal Complexes: Valence bond theory, applications and their Limitation, Elementary idea of CFT (Only structural aspects), Crystal field splitting in octahedral, tetrahedral and square planer complexes. Magnetic properties of transition metal complexes: Types of magnetic materials, magnetic susceptibility, method of determination, spin only formula, basic idea of L-S coupling.	11
II	Thermodynamics-II: Third Law of Thermodynamics, Nernst Heat Theorem, Statement of concept of residual entropy, evaluation absolute entropy from heat capacity data. Gibbs function and Helmholtz Function as thermodynamic quantities. Criteria for thermodynamic equilibrium and spontaneity. Variation of G with P, V and T, Partial molar properties, concept of chemical potential (numerical included) Phase Equilibria: Statement and the meaning of terms-phase component and degree of freedom. Thermodynamic derivation of Gibbs phase rule. Phase equilibria of one component system-water system, phase equilibria of two component systems solid-liquid equilibria, simple Eutectic Pb-Ag system.	11
III	Quantum Mechanics-I: Black body radiation, plank's radiation law, Explanation of spectral distribution of black body radiation on the basis of classical mechanics and quantum mechanics, Heat capacity of solids, Need of quantum mechanics, postulates of quantum mechanics, quantum mechanical operator, Commutation relations, Hamiltonian operator, Role of operators to derive Schrodinger wave equation. Application Schrodinger wave equation in determination of wave function and energy of a particle in one dimensional box Spectroscopy-I: Electromagnetic radiations, reasons of electromagnetic spectrum, basic features of spectroscopy, introduction to molecular spectroscopy and its difference from atomic spectroscopy, signal to noise ratio, resolving power of spectrophotometer. Born-Oppenheimer approximation, Concept of degree of freedom. Rotational Spectrum: Energy levels of rigid rotator of diatomic molecules, selection rules, spectral intensity distribution using Maxwell-Boltzmann distribution, Determination of bond length and concept of isotopic effect	11

IV	Organic Synthesis via Enolates Acidity of α -hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Heterocyclic Compounds Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.	12
V*	1. Systematic identification (detection of extra elements, Functional Groups, determination of Melting Point and preparation of atleast one solid derivative) of the following simple mono-functional organic compounds: Naphthalene, p-dichlorobenzene, m-dinitrobenzene, α & β naphthol, Oxalic acid, succinic acid, benzoic acid, phthalic acid, Benzamide, urea, thiourea, glucose, fructose and sucrose. 2. Determine the solubility product of $\text{Ca}(\text{OH})_2$ at room temperature by titrating it against 0.5 N HCl solution volumetrically. 3. Determine electrode potential of Zinc and Copper electrode in 0.1 M and 0.01M solution and calculate E° value for these electrodes.	30
Suggested Evaluation Methods		
Internal Assesment:20+10* > Theory • Class Participation: 5 • Seminar/Presentation/Assignment/Quiz/Class Test etc: 5 • Mid Term Exam: 10 > Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc: 10 • Mid-Term Exam: NA		End Term Examination: 50+20*
Part C- Learning Resources		

Recommended Books/e-resources/LMS:

1. Organic Chemistry Volume III by Mukherji, Singh, Kapoor and Dass, Published by New Age International Pvt. Ltd., New Delhi.
2. Huheey, J.E.; Keiter, E.A., Keiter, R. L.; Medhi, O.K. (2009), Inorganic Chemistry Principles of Structure and Reactivity, Pearson Education.
3. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010), Inorganic Chemistry, 5th Edition, W. H. Freeman and Company
4. Lee, J.D.; (2010), Concise Inorganic Chemistry, Wiley India.
5. Peter, A.; Paula, J. de. (2011), Physical Chemistry, 9th Edition, Oxford University Press.
6. Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.
7. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 2, 6th Edition, McGraw Hill Education.
8. Kapoor, K.L., A Textbook of Physical Chemistry, Vol 3, 5th Edition, McGraw Hill Education
9. House, J.E. (2004), Fundamentals of Quantum Chemistry, 2nd Edition, Elsevier.
10. McQuarrie, D.A. (2016), Quantum Chemistry, Viva Books.
11. Chandra, A. K. (2001), Introductory Quantum Chemistry, Tata McGraw-Hill.
12. House, J.E. (2004), Fundamentals of Quantum Chemistry, 2nd Edition, Elsevier
13. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson 75 Education).
14. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I.K. International
15. B.D. Khosla, V.C.Garg, A. Gulati, Senior Practical Physical Chemistry R. Chand & Company, New Delhi

*Applicable for courses having Practical component

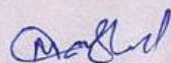
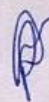



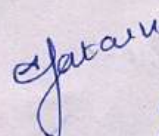



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CC-6

Session 2023-24			
Part A- Introduction			
Subject	Chemistry		
Semester	VI		
Name of Course	Chemistry-VI		
Course Code	B-23 CHE-601		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of Course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Enable to understand the chemistry of bioinorganic molecules. 2. To learn about fundamentals of photochemistry and photophysical processes. 3. To understand the concept of IR and NMR spectroscopy of organic compounds. 4. Enable to understand the synthesis and other properties of amino acids, carbohydrates and their derivatives. 5*. Hand on practice in preparation of organic/ inorganic compound, and determination of strength of various types of solutions using various instruments.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max marks:70+30* Internal Assessment Marks:20+10* End Term Exam Marks:50+20*	Examination Time:03+03* Hours		
Part B- Contents of the Course			




Instructions for Paper-Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No. 1) based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics	Contact Hours
I	Bioinorganic chemistry Metal ions present in biological system, classification based on action (essential, non-essential, trace, toxic). Metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of Na^+ , K^+ , Ca^{+2} , Mg^{+2} , Fe^{+2} ions, Cooperativity effect, Bohr effect.	12
II	Photochemistry Interaction of radiation with matter, difference between thermal and photochemical process, Law of photochemistry: Lambert-Beer Law, Grotthus-Draper Law, Stark Einstein Law (Law of photochemical equivalence), calculation of integrated absorption coefficient from electronic spectra, oscillator strength, concept of singlet and triplet states, Jablonski diagram – depicting various process occurring in excited states including fluorescence, phosphorescence and non-radiative processes (internal conversion, intersystem crossing). Calculation of lifetime of excited states. Quantum Yield. Photosensitized reaction- energy transfer process (Simple example).	11
III	IR Spectroscopy Infrared (IR) absorption spectroscopy Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. NMR Spectroscopy Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift, shielding and deshielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons. Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide and 1,1-dibromoethane.	11

IV	Amino Acids, Peptides Amino acids, Peptides, and their classification. α -Amino Acids- Synthesis, ionic properties, and reactions. Zwitterions, pKa values, isoelectric point, and electrophoresis; Study of peptides: Synthesis of peptides using N-protecting, C-protecting, and C- activating groups. Carbohydrates Occurrence, classification, and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projection and conformational structures; Interconversion of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation.	11
V*	1. To determine the strength of given acid solution (mono acid only) conductometrically. 2. To determine the solubility and solubility product of sparingly soluble salt using conductometer. 3. To determine the strength of given Mohr's salt solution using potentiometer. 4. To determine the molecular weight of organic compound by Rast method. 5. To determine the specific rotation of an optically active substance by polarimeter. 6. To prepare a sample of p-bromoaniline from p-bromoacetanilide. 7. To prepare a sample of cuprous chloride. 8. To study the photochemical reaction of benzophenone and isopropyl alcohol.	30
Suggested Evaluation Methods		
Internal Assesment:20+10* > Theory • Class Participation: 5 • Seminar/Presentation/Assignment/Quiz/Class Test etc: 5 • Mid Term Exam: 10 > Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc: 10 • Mid-Term Exam: NA		End Term Examination: 50+20*
Part C- Learning Resources		

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Recommended Books/e-resources/LMS:

1. Organic Chemistry Volume II & III by Mukherji, Singh, Kapoor and Dass, Published by New Age International Pvt. Ltd., New Delhi.
2. Huheey, J.E.; Keiter, E.A., Keiter, R. L.; Medhi, O.K. (2009), Inorganic Chemistry Principles of Structure and Reactivity, Pearson Education.
3. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010). Inorganic Chemistry, 5th Edition, W. H. Freeman and Company
4. Lee, J.D.; (2010), Concise Inorganic Chemistry, Wiley India.
5. Pavia, D. (2015), Introduction to Spectroscopy, Fifth Edition, Cengage Learning India Pvt. Learning.
6. Ahluwalia, V.K., Parashar, R.K. (2011), Organic Reaction Mechanisms, 4th Edition, Narosa Publishing House.
7. Horspool, W.M. (1976) Aspects of Organic Photochemistry, Academic Press.
8. Singh J, Awasthi S K, Singh J. Fundamentals of Organic Chemistry. Pragati Prakashan Meerut.
9. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 3, 6th edition, McGraw Hill Education.
10. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 5, 6th Edition, McGraw Hill Education.
11. Kuashik, S., Singh, A. (2023). Biomolecules: From Genes to Proteins, First Edition, Berlin, Boston: De Gruyter.
12. DeMan, J.M., Finley, J.W., Hurst, W.J., Lee, C.Y. (2018), Principles of Food Chemistry, Fourth Edition, Springer.

*Applicable for courses having Practical component

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