Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur (C.G.)

Scheme and Syllabus

of

M. Sc. (Chemistry)

Program Code: MSCCHER102

Semester system for affiliated college
(As per LOCF and credit system)

w.e.f. 2023-2024

(As approved by AC and EC meetings held on 16.08.2023 and 18.04.2023 respectively)

अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

कोनी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009

Website :www.bilaspuruniversity.ac.in

Scheme of M.Sc. (Chemistry) under Semester System
Program Code: MSCCHER102

Semester	Course Code	Subject Name	Credit			Total Credit	Marks			
							ESE	IA	Total	
			L	T	P				Max	Min
First	CHEMT101	Inorganic Chemistry	3	1	-	4	80	20	100	36
	CHEMT102	Organic Chemistry	3	1	-	4	80	20	100	36
	CHEMT103	Physical Chemistry	3	1	-	4	80	20	100	36
	CHEMT104	Spectroscopy & Maths. for chemist	3	1	-	4	80	20	100	36
	CHEMP101	Lab 1 Organic Chemistry	-	-	2	2	-	-	100	36
	CHEMP102	Lab 2:Analytical Chemistry	-	-	2	2	-	-	100	36
	Subtotal		**12**	**4**	**4**	**20**	-	-	**600**	-
Second	CHEMT201	Inorganic Chemistry	3	1	-	4	80	20	100	36
	CHEMT202	Organic Chemistry	3	1	-	4	80	20	100	36
	CHEMT203	Physical Chemistry	3	1	-	4	80	20	100	36
	CHEMT205	Elective-I A: Photo-inorganic chemistry	3	1	-	4	80	20	100	36
	CHEMT206	Elective-I B: Chemistry of Hetrocyclic compounds								
	CHEMT207	Elective-I C: Chemistry of Material								
	CHEMP201	Lab 3: Inorganic Chemistry	-	-	2	2	-	-	100	36
	CHEMP202	Lab 4: Project Work	-	-	2	2	-	-	100	36
	Subtotal		**12**	**4**	**4**	**20**	-	-	**600**	

M.Sc. Chemistry

Programme outcome

After completing M.Sc. Chemistry programme, students will be able to:

Knowledge Outcomes:

PO1: Demonstrate and apply the fundamental knowledge of the basic principles in various fields of Chemistry

PO2: Create awareness and sense of responsibilities towards environment and apply knowledge to solve the issues related to Environmental pollution.

PO3: Apply knowledge to build up small scale industry for developing endogenous product.

PO4: Apply various aspects of chemistry in natural products isolations, pharmaceuticals, dyes, textiles, polymers, petroleum products, nanopartcles,computer programming for chemists etc. and also todevelop interdisciplinary approach of the subject.

Skill Outcomes: It would help students to

PO4: collaborate effectively on team-oriented projects in the field of Chemistry or other related fields.

PO5: communicate scientific information in a clear and concise manner both orally and in Writing.

PO6: inculcate logical thinking to address a problem and become result oriented with a positive attitude.

PO7: Explain environmental pollution issues and the remedies thereof.

PO8: apply the knowledge to develop the sustainable and eco-friendly technology in Industrial Chemistry.

Generic Outcomes:

PO9: Have developed their critical reasoning, judgment and communication skills.

PO10: Augment the recent developments in the field of green and eco-friendly reactions, pharmaceutical, Bioinorganic Chemistry and relevant fields of research and development.

PO11: Enhance the scientific temper among the students so as to develop a research culture and implementation of the policies to tackle the burning issues at global and local level.

PO12 :Will be able to undertake various projects of chemistry and will be familiar about research methodology.

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Part A: Introduction			
Program: M.Sc. Chemistry		Semester: I	w.e.f.: **2023-2024**
1.	Course Code	**CHEMT101**	
2.	Course Title	**Inorganic Chemistry**	
3.	Course Type	**Theory**	
4.	Pre-requisite (if any)	**As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur**	
5.	Course Learning. Outcomes(CLO)	**At the end of this course, the students will be able to:** • To give better knowledge of basic Inorganic chemistry • Learn bonding & stereo chemical structures of transition metal complexes, Molecular orbital theory. • Electronic spectra of transition metal complexes • Magnetic Properties of transition metal complexes • Basic principles of symmetry and group theory	
6.	**Credit Value**	**(3L +1T) = 04**	
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Stereochemistry and Bonding in Main group compounds** - VSEPR theory, Walsh Diagram (Tri and Penta atomic molecules] dπ- pπ bonds, bent rule and energetic of hybridisation, some simple reaction of covalently bonded molecules.	12
II.	**Metal-ligand bonding:** Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes. π-bonding & molecular orbital theory.	12
III.	**Electronic spectra of transition metal complexes** - Energy levels in an atom, coupling of orbital angular momentum, determination of ground state term, derivation of term symbols. Electronic spectra of Transition metal complexes, Orgel and Tanabe- Sugano-diagrams for Transition metal complexes	12
IV.	**Magnetic Properties of transition metal complexes**- Anomalous magnetic moment, Calculation of Magnetic moment, Orbital Contribution,Effect of Ligand field, Application of Magneto chemistry in Structure Determination, Magnetic Exchange coupling and spin crossover, charge transfer spectra.	12

V.	**Symmetry and Group theory in chemistry**: Symmetry elements and symmetry operation, Centre of Symmetry, Plane and its types of Symmetry,Proper and Improper axis of Symmetry, Principal axis and subsidiary axis,The concept of groups,Assigning Point groups with illustrative examples,Symmetry operations and order of a group, Group theoretical rules (Group postulates) , Reducible and Irreducible representations, Matrix representations of symmetry operations. Definitions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Point symmetry group. Schoen fliessymbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnhetc. groups to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables of C2V, C2h, C3V and their use in spectroscopy.	12

Part C - Learning Resource

Reference Books,

1. Group Theory - Bhattacharya
2. Advance Inorganic Chemistry – F.A. Cotton and Wilkinson: John Wiley.
3. Inorganic Chemistry - J.E. HuheyHarpes& Raw
4. Chemistry of the elements - N.N. Greenwood & A EarnshowPergamon.
5. Inorganic Electronic Spectroscopy - A.B.P. Lever, Elsevier.
6. Magneto Chemistry - R.L. Carlin Springer Veriag.
7. Comprehensive Co-ordination Chemistry, G. Wilkinson R.D. Gillar's and J.A. MccleverтyPergamon.
8. Chemistry Applications of Group Theory - F.A. Cotton.
9. A Textbook of Inorganic Chemistry ,MandeepDalal ,Dalal Institute

E-Resources-

https://drive.google.com/file/d/1WrC3Rp3P9NPqijPd- RPpGIEzevnTRZx/view

https://www1.udel.edu/chem/mpwatson/mpwatson/Chem_633_files/Pericyclic_Reactions_handout%20for%20lecture.pdf

https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCY1620.pdf

Sr. No.	Chemistry, B.O.S. Chairman/Member's Name	Signature
1	Mr. L.C. Manwani Asstt. Prof., Dr. B.S. Porte Govt. College, Pendra	
2	Dr. Smt Harsha Sharma Asstt. Prof., C.M.D. PG College, Bilapsur	
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4	Smt. Sapna Pawar Asstt. Prof., Govt. N.P.K. College Kota	
5	Dr. Smt Seema Negi Asstt. Prof., Govt. J.M.P. College Takhatpur	
6	Dr. Neeta Gupta Asstt. Prof., Govt. E.R.R. Science College Bilapsur	

Part A: Introduction			
Program: M.Sc. Chemistry		Semester: I	w.e.f.:2023-2024
1.	Course Code	**CHEMT102**	
2.	Course Title	**Organic Chemistry, Stereochemistry and Pericyclic Reactions**	
3.	Course Type	**Theory**	
4.	Pre-requisite (if any)	**As per Rules of Atal Bihari Vajpayee VishwavidyalayaBilaspur**	
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • To give better knowledge of basic organic chemistry • Better understanding required for stereo chemical structures, conformational isomers • Better Practice for the use of special synthetic reaction in the path of synthetic ways • Use of spectroscopy IR, NMR and Mass spectrograph for organic chemical. • Objective questions practice.	
6.	**Credit Value**	**(3L +1T) = 04**	
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Reaction Mechanism : Structure and Reactivity :** Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate. potential energy diagrams, transition states and intermediates, methods of determining mechanism, isotope effects. Hammett equation and linear free energy relationship, substituent and reaction constants. **Reaction Intermediates :** Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes, and benzynes. Application of NMR in detection of carbocations.	12
II	**Priciples of stereochemistry:** Conformational analysis of cycloalkanes, decalinseffect of conformation on reactitity, conformation of sugars, steric strain due to unavoidable crowding. Elements of symmetry, chirality, molecules with more than one chiral centre, threo and erythro isomers, methods of resolution, opticalpurity, enantiotopic and diastereotopic atoms, groups and faces, stereospecfic and stereo selective synthesis. Asymmetric synthesis, optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes). chirality due to helical shape.Stereo chemistry of the compoundcontainingnitrogen,sulphur and phosphorus. Practice of configurational and conformational isomerism in acyclic and cyclic compounds; stererogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. **Asymmetric synthesis:** Chiral auxiliaries, methods of asymmetric induction-substrate, reagent and catalyst controlled reactions; determinations of enantiomeric and diastereomeric excess; enantio- discrimination. Resolution - optical and kinetic.	12

III	**Nature of Bonding in Organic Molecules** : Delocalized chemical bonding ,conjugation, cross conjugation, resonance, hyperconjugation,Steric effect, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of molecular orbitals, annulenes, homo-aromaticity, PMO approach. Aromaticity: Benzonoid and non-benzenoid compounds-generation and reactions.	12
IV	**Pericyclic Reactions :** Molecular orbital symmetry, frontier orbitals of ethylene ,1,3-butadiene, 1,3,5- hexatriene and allyl system. Classification of pericyclic reactions. Wood ward-Hoffmann correlation diagrams, FMO and PMO approach. Electrocyclic reactions, Conrotatory~anddisrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions - antrafacial and suprafacial additions, 4n, 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cyclo additions and cheleotropic reactions. Sigmatropic rearrangements - Suprafacial and antrafacial shifts of H .sigmatropic shifts involving carbon moieties 3,3 and 5,5- Sigmatropicrearrangements,Claisen,Cope and Aza-Cope rearrangements.Fluxionaltautomerism, Ene reaction. Principles and applications of photochemical reactions in organic chemistry.	12
V	**Molecular rearrangement :** General mechanistic approach to molecular rearrangement reactions, migratory aptitude and memory effects. Brief study of following rearrangement reactions. carbocation rearrangement Favoroskii, Baeyer-Villigers oxidation, Stork enamine reaction, Shapiro reaction, Sommelet rearrangement, wittig's rearrangement, Grovenstein-Zimmerman rearrangement. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselectivetransformations.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Reference Books:-

1. Advanced Organic Chemistry - Reaction Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry - F.A. Carey and R.K. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry- Peter Sykelongman.
4. Structure and Mechanism in organic chemistry - C.K. Ingold, Cornell University Press.
5. Organic Chemistry - R.T. Morrison and R.N. Boyed Prentice - Hall.
6. Modern Organic Reactions - H.O. House, Benzamic.
7. Principles of Organic Synthesis - R.P.C. Norman and J.M. Coxon, Blackie Academic and Professional.
8. Pericyclic Reaction - S.M. Mukherji.
9. Reaction Mechanism in Organic Chemistry - S.M. Mukherji and S.P. Singh Macmilan.

10. Stereochmistry of Organic compounds - D. Nasipuri New age International.
11. Sterochemistry of Organic Compounds - P.S. Kalsi, New Age International.

E-Resources:

https://drive.google.com/file/d/1WrC3Rp3P9NPqijPd- RPpGIEzevnTRZx/view

https://www1.udel.edu/chem/mpwatson/mpwatson/Chem 633 files/Pericyclic Reactions handout%20for%20lecture.pdf

https://sist.sathyabama.ac.in/sist coursematerial/uploads/SCY1620.pdf

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Part A: Introduction			
Program: M.Sc. Chemistry		Semester: I	w.e.f.:2023-2024
1.	Course Code	CHEMT103	
2.	Course Title	Physical Chemistry	
3.	Course Type	Theory	
4.	Pre-requisite (if any)	As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur	
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • To give better knowledge of basic of quantum chemistry • Better understanding of electronic structure of atom and molecular orbitals. • Better approach towards dynamics of chemical reactions. • Use of surface chemistry specially in micelles and adsorption. • To understand about macromolecules ,polymers.	
6.	Credit Value	(3L +1T) = 04	
7.	Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	**Quantum Chemistry:** The Schrodinger equation and the postulates of 'Quantum mechanics. Discussion of solution of the Schrodinger equation to some model systems, viz. particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom. **Approximate methods:** The various theorems, linear variation principle. perturbation (first order and non - degenerate). Application of variation method and perturbation theory to the Helium atom. **Angular Momentum:** Ordinary angular momentum, generalized angular momentum, Eigen functions for angular momentum, Eigenvalue of angular momentum, operator using ladder operators, addition of angular momentum, spin anti-symmetry and pauli Exclusion Principle.	12
II.	**Atomic Chemistry:** Electronic Configuration Russell- Saunders term and coupling scheme. Slater- condon parameters, term separation energies of P^n configuration, term separation energies for d^n configurations, magnetic effects: spin- orbital coupling and Zeeman splitting, introduction to the method of self – consistent field, the virial theorem. **Molecular Orbital Theory:** Huckel Theory conjugated system, bond order and charge density calculations. Applications to ethylene, butadiene, cyclopropenylradical ,cyclobutadience etc. introduction to extended Huckel theory.	12
III.	**Chemical Dynamics:** Method of determining rate laws, collision theory of reaction rates, steric factor, activated complex Theory, Arrhenius equation and the activated complex theory, ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dynamic chain (hydrogen-bromine reaction,' pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-bromine and .hydrogen-chlorine reactions) and oscillatory reactions (Belousov - Zhabotinsky reaction), homogeneous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and nuclear magnetic resonance method, Dynamics of molecular motions, probing the transition state, dynamics of barrier less chemical reactions in solution, dynamics of unimolecular reactions	12

	(Lindemann-Hinshelwood and Rice- Ramsperger-Kassel-Marcus [RRKM] theories of unimolecular reactions).	
IV.	**Surface Chemistry:-Adsorption:** Surface tension, capillary action, pressure difference across curved surface (Laplace equation, vapour pressure of droplets (Calvin equation, and Gibs adsorption isotherm, estimation of surface area (BET equation, surface film on liquids (ElectronkinetcPhenomina) catalytic activity of surfaces. **Micelles:** Surface active agents, classification of surface active agents, micellization, hydrophobic interactin, critical micellar concentrating (CMC), factor affecting the CMC of surfactants, counter ions binding to micelles, thermodynamics of micellization- phase separation and mass action models, solubilization, micro emulsion, reverse micelles.	12
V.	**Macromolecules:** Polymer- definition, types of polymers, electrically conducting, fire resistant; liquid crystal polymers, kinetic of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, viscometry, diffusion and light scattering method), sedimentation, chain configuration of macro molecules, calculation of various chain structures.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Reference Books:-

1. Physicial Chemistry; P. W. Atkins, ELBS.
2. lntroduction to Quantum Chemistry; R. K. Chandra, Tata McGraw Hill.
3. QgantumQhemistry; lra. N. Levine, Prentice Hall.
4. Coulson's Valence; R. IVlc Weeny, ELBS.
5. Micelles Theor,etical and Applied Aspects; V. Moroi, Plenum.
6. lntrodilction to Polyiner Science; V. R. Gowarikar,N. V. Vishwanathanand J. Sridhar, Wiley Eastern. 7. Physicel"Chemistry of Surface; A. W. Anderson and A. Gast; Wiley
7. Surfai6s;.G. Attard and C.Barnes, Oxford Univ. press.
8. lnirodu0tion to Solid state physics. Kittel, Wiley.
9. Crystal structure deterrnination; W. Clegg, Oxford University Press

E-Resources:

https://drive.google.com/file/d/1WrC3Rp3P9NPqijPd- RPpGIEzevnTRZx/view

https://www1.udel.edu/chem/mpwatson/mpwatson/Chem 633 files/Pericyclic Reactions handout%20for%20lecture.pdf

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Part A: Introduction			
Program: M.Sc. Chemistry		Semester: I	w.e.f.:2023-2024
1.	Course Code	CHEMT104	
2.	Course Title	SPECTROSCOPY AND MATHMATICS/BIOLOGY FOR CHEMISTS	
3.	Course Type	Theory	
4.	Pre-requisite (if any)	As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur	
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • To understand various spectroscopic methods • Better understanding of microwave and raman spectroscopy • Better Practice of vibrational spectroscopy . • Maths student of graduate level will be familiar with biological aspects of chemistry • Biology students of graduate level will be able to understand various mathematical concepts used in chemistry.	
6.	Credit Value	(3L +1T) = 04	
7.	Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	**SECTION-A** **Spectroscopy Unifying Principles**: Electromagnetic radiation, Interaction of Electromagnetic radiation with matter, absorption, emission, transmission, reflection, refraction, dispersion, polarization and scattering. Uncertainty relation and Natural line width and natural line broadening. Transition Probability, results of the time dependent perturbation theory, transition moment. Selection rules, intensity of spectral lines. Born- Oppenheimer approximating, Rotational, Vibratinal and Electronic Energy Levels.	12
II.	**Microwave Spectroscope**: Classification of Molecules, rigid rotor model,effect of isotopic substitution on the transition frequencies, Intensities, non- rigid rotor. Stark effect, Nuclear and Electron spin Interaction. **Raman Spectroscopy:** Classical & Quantum Theories of Raman Effect. Pure rotational, vibrational & vibrational rotational Raman Spectra, Selection rules. Mutual exclusion Principle, Resonance Raman Spectroscopy, CoherentAntistokesRaman Spectroscopy.	12
III.	**Vibrational Spectroscopy :** Infrared Spectroscopy ,Review of linear harmonic oscillator, vibrational energies of diatomic molecules, Zero point energy, force constant and bond strengths,anhormonicity, morse potential energy diagram, vibrationalrotation spectroscopy. P.Q.R- branches. Breakdown of oppenheimer approximation. Vibration of poly atomic molecules. Selection rules, normal rnodes of vibration, group frequencies overtones hot bands factors affecting the band positions and intensities for IR region.	12

IV.	**SECTION-B** **MATHEMATICS FOR CHEMISTS (for bio students)**	
	Vector and Matrix Algebra Vectors: - Vector dot, cross and triple products etc. The gradient divergence and curl. Vector calculus, gauss Theorem divergence Theorem etc. **Matrix Algebra:** Addition and Multiplication, inverse, adjoint and transpose of matrices. Special matrices. (Symmetric, Skew symmetric, diagonal, unitary etc.) And their properties, matrix equation, Homogeneous, Non Homogeneous linear equations. **Differential Calculus:** Functions, continuity and differentiability rules for differentiation, Applications of differential calculus. including maxima and minima. Exact & inexact differentials with their Application to thermodynamics proprieties. integral calculus, basic Rules for integration, integration by parts, partial fraction and substitution. Reduction formulae, Applications of integral-Calculus. Functions of several variables.	12
V.	**Elementary differentiate equations:** Variables-Separable and Exact First-order, differential equation, homogeneous, Exact and linear equation. Applications to Chemical Kinetics, Secular Equilibrium quantum chemistry. **Permutation and Probability:** Permutations and combinations, probability and probability theorem, probability curves, average, root mean square and most Probable errors, examples from kinetic theory of gases.	12
	OR	
IV.	**SECTION-C** **BIOLOGY FOR CHEMISTS (for maths students)**	12
	Cell Structure and Functions: Structure of prokaryotic and eukaryotic cells ,Intercellular organelles and their functions. Comparison of Plant and animal cells. Overview of metabolic processes- catabolism and anabolism. ATP- The biological Energy currency. Origin of life- unique properties of carbon, Chemical evolution and rise of living systems. Introduction to bio molecules, building blocks of Bio-macromolecules. **Carbohydrates:** Conformation of mono-saccharides, structure and function of important derivatives ofmonosaccharideLike glycosides-deoxy sugar, myo-inositol, Aminosugar, disaccharides and polysaccharides structural. Poly saccharides -cellulose and chitin. Storage polysaccharides -starch and glycogen. Carbohydrate of glycol protein and glycolipidds. Role of sugar in biological recognition. Blood group substarices. Ascorbic Acid, Carbohydrate metabolism., Krebs cycle, Glycolysis, Glycogenesis and Glycognolysis, Gluconeogenesis, pentose phosphate pathway.	

V.	**Lipids:** Fatty acids, essential fatty acids, structure and function of triglycerals glycerophosopholipids, Sphingolipids cholesterol, bile acids, prosta-glandinslipo proteins composition and function role in atherosclerosis. Properties of lipid aggregates micelles bilayers. Liposomes and their possible biological functions, Biological membranes, fluid mosaic model of membrane spectra liquid metabolism. B- Ixudatuib, fatty acids. **Amino acids, Peptides and Proteins**: Chemical & enzymatic hydrolysis of proteins to peptides, Amino Acid sequencing, secondary structure of proteins, forces responsiblefor holding of secondaryStructure. α-helix, B-sheets super secondary structure, triple helix structure of collagen, Tertiary structure of protein folding and domain structure. Quaternary structure. Amino Acid metabolism, degradation and biosynthesis of Amino acid. Sequence determination. Chemistry of Oxytocin and tryptophane releasing hormones (TRH) **Nucleic Acid:** Purine, Pyrimidine, bases of Nucleic acid, base pairing, via H-bonding, structure of Ribo Nucleic Acid (RNA) & D-N.A. deoxy ribonucleic acid, double helix model of DNA and forces responsible for holding at chemical and Enzymatic Hydrolysis of Nucleic Acid. The Chemical bases of heredity, an overview of replication of DNA. Transcription, translation and genetic code, chemical synthesis of mono and Trinucleosides.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Reference Books:-

1. 1.Modern Spectroscopy - J.M. Hollas Hohnwiley.
2. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windowi and F.L. Ho Witley interscience.
3. NMR, NQR, ESR and mossbaure spectroscopy in lnorganic chemistry :- R.V. Parish, Ellis Harwood.
4. Physical Method in Chemistry - R.S. Drago, Saunders College.
5. 5- lntroduction to Molecular Spectroscopy - G.M. Barrow, Mcgraw Hill.
6. Basic Principle of Spectroscopy- R. Chang tVlcgraw Hill.
7. Theory and Application of Uv Spectroscopy H.H. Jaffe, and M. Orchin, IBH Oxford.
8. lntroduction to Photo electron spectroscopy P.K. Ghosh John Wiley.
9. lntroduction to magnetic Resonance, a. carrington and A.D Row. Maclachalan Harper &
10. H. Kaur, Spectroscopy,Wiley,

Books : Mathematics' for" chemists.

1. The Chemistry Mathemetics Book: E.Steiner, Oxford University Press.
2. Mathematics for Chemistry- Doggett and Sectcliffe longman
3. Mathematical preparation for physical chemistry0 F. Daniels MC grow Hill.

4. Chemical mathematics- D.M. Hirsl- Longmann.
5. Applied Mathematics for Physical Chemistry J.R. Barrate, Prentice Hall.
6. Basic mathematics for Chemists tebbutt Wiley.

Books -Biology for chemists

1. Principles of Biochemistry , A.L. Lehninger, worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman
3. Biochemistry, J.David. Rawn, Neil Patterson.
4. Biochemistry, Voet & Voet John Wiley
5. Biochemistry, Jain & Jain S. Chand

E-Resources:

https://drive.google.com/file/d/1WrC3Rp3P9NPqijPd- RPpGIEzevnTRZx/view

https://www1.udel.edu/chem/mpwatson/mpwatson/Chem_633_files/Pericyclic_Reactions_handout%20for%20lecture.pdf

https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCY1620.pdf

Sr. No.	Chemistry, B.O.S. Chairman/Member's Name	Signature
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2	Dr. Smt Harsha Sharma Asstt. Prof., C.M.D. PG College, Bilapsur	
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अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

कोनी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009

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M.Sc. - I SEMESTER			
Part-A: Introduction			
Program: Certificate Course		Session-2023-24	
1.	Course Code	**CHEMP101**	
2.	Course Title	**LAB-1 Organic Chemistry**	
3.	Course Type	**Laboratory Course**	
4.	Pre-requisite (if any)	As per Atal Bihari vajpayeevishwavidyalaya Rules	
5.	Course Learning Outcome(CLO)	At the end of this course, the students will be able to learn the following aspects of Chemistry	
		• To separate and Identify binary Organic mixture • Functional Group Analysis by T.L.C., Column chromatography & I.R. spectroscopy. • Synthesis of Organic Compounds • QualitativeAnalysis	
6.	Credit Value	**02**	
7.	Total Marks	Max. Marks:100	Min.-36

Part-B: Content of Course	
Total No. Of Lectures:	
1.	**Qualitative analysis:-** Separation, purification and identification of binary mixture (one liquid and one solid), using T.L.C. and column chromatography, Chemical test, I.R. spectra may be used for functional group identification.
2.	**Organic Synthesis:-** 1.Acetylation of Cholesterol and separation of Cholesteryl acetate by column chromatography. 2.Oxidation of Adipic acid by chromic acid. Oxidation of cyclohexanol. 3.Grignard's reaction : Synthesis of triphenylmethanol from Benzoic acid. 4.Aldol condensation : dibenzalacetone from Benzaldehyde 5.Sandmeyer Reaction : p-chloro Toluene from Toluidine. 6 .Hoffman Bromide Reaction. Prepration of AnthranilicAcid from Pthallic anhydride 7.Friedle Craft's reaction : p-Benzoyl propanoic acid from succinic anhydride and Benzene 8.Aromatic electrophilic substitution : nitration and bromination of aniline/acetanilide Products may be characterised by Spectral techniques. Note: Two stage preparation. Preparation of pure and crystalline compounds based

	on any two of above principals with confirmation of melting points.
3.	**Quantitative Analysis** 1.Determination of the percentage number of hydroxyl groups by Acetylation method. 2.Estimation of amine/phenols using Bromate Bromide solution or Acetylation method. 3.Estimation of Carbonyl group by hydrozane method. 4.Estimation of Glycine by titration. 5.Determination of equivalent weight of carboxylic compounds. 6.Estimation of carboxyl group by titration/Silver salt method.
	Distribution of Marks:- (Marks of Ex students are given in paranthses a.Qualitative analysis of mixture containing two organic compounds - 30 (40) marks b.Two stage preparation - 20(30) marks c.Viva voce and manipulation - 20 (30) marks d.Sessional marks - 30 (-) **Total - 100 marks** **Awards of Marks:** (a) Separation of mixture 10 (12) marks, Name of compounds10 (12) marks, for using correct method and writing systematic procedure of identification of each compound 10(16) marks. **(b)** Preparation, first stage 10 (15) marks, second stage10 (15) marks.

Part-C Learning Resources

Reference Books

Arthur I.Vogel, A text book of Practical Organic Chemistry, ELBS

Raj K. Bansal, Laboratory Manual of Organic Chemistry, Wiley Eastern limited.

N.N. Greenwood and A. Earnshaw, Chemistry of the Elements, Vol.II, Pergamon Press (1997)

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M.Sc. I SEMESTER			
Part-A: Introduction			
Program: Certificate Course		Session-2023-24	
1.	Course Code	**CHEMP102**	
2.	Course Title	**LAB-2 (Analytical Chemistry)**	
3.	Course Type	**Laboratory Course**	
4.	Pre-requisite (if any)	**As per Atal Bihari vajpayee vishwavidyalaya Rules**	
5.	Course Learning Outcome(CLO)	At the end of this course, the students will be able to learn the following aspects of Chemistry	
		• Errors Analysis & Statistical Data Analysis • Volumetric Analysis & Gravimetric Analysis spectroscopy. • Chromatography Techniques • pH &Potentiometry • The applications of flame photometer, colorimeter,Spectrophotometer, Nephlometer etc. in analysis	
6.	Credit Value	02	
7.	Total Marks	Max. Marks:100	Min.-36

Part-B: Content of Course	
Section-A	
	1.Error Analysis and Statistical data Analysis: Calibration of volumetric apparatus, burrettes, pipette, standard flask, weight box etc. **2.Volumetric Analysis:** Basic principles. Determination of Iodine and saponification values of oil sample. Determination of DO, COD,BOD, Hardness of water samples. **3.Gravimetric Analysis:** Determination of metal ions e.g. Ni, Cu etc, by gravimetric method using organic pracipitants such as dimethylglyoxime,dithizone and β-hydroxyquinoline etc. **4.Chromatography:Separation of cations and anions by** (a)Paper Chromatography (b) Column Chromatography

Section-B	
2.	**1.Ph metry/ Potentiometry:** Determination of strength of acids etc. **2.FlamePhotometry/AAS/FIA/Colorimetry:** Determination of cations/anions and metalions eg.Na+, K+, Ca+2, SO42-,NO2-, Fe, Mo, Cu, Zn etc. **3.Spectrophotometry:** Verification of Beer - Lamert Law. Molar absorptivity calculation, plotting graph to obtain λ_{max} etc. effect of pH in aqueous colored system. Determination of metal ions eg. Fe, Cu, Zn, Pb etc. using inorganic reagents like SCN and organic chelating agent like dithzone,cuferron, hydroxiquinoline etc. in aqueous / organic phase in the presence of surface active agents. **4.Nephelometry/Turbidimetry:** Determination of chloride, phosphate, sulphate, turbidity etc. **5.Application of Computer in Chemistry :**
3.	.
	Distribution of Marks:- (Marks of Ex students are given in paranthses a) Two practical exercise 60 (80) marks (at least one of these will be based on instrumental analysis) (b) Viva voice and manipulation 20 (20) marks (c) Sessional 30 (….) marks **Total Marks 100** **Awards of Marks:** As far as possible all the exercises as laid down in the syllabus are set. The scale of marking will be determined by examiners in accordance with the nature of exercises. Sessional marks will be awarded by External Examiner in consultation

	with the internal Examiner.

Part-C Learning Resources

As specified in theory paper.Books suggested:

1. Vogel`s Test book of Quantitative Analysis revised; Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.
2. Findley`s Practical Physical Chemistry; B. P. Lavitt, Longman.
3. Experimental Physical Chemistry; R. C. Das and B. Behera , Tata McGraw Hill.

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Part A: Introduction			
Program: M.Sc. Chemistry	Semester: II		w.e.f.: **2023-2024**
1.	Course Code	**CHEMT201**	
2.	Course Title	**Inorganic Chemistry**	
3.	Course Type	**Theory**	
4.	Pre-requisite (if any)	**As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur**	
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • UnderstandLogic of mathematical/ computational methods adopted for the determination of stability • Understand Reaction mechanism of transition metal complexes • Understand Stereochemistry involve in the substitution in Square Planar Complexes • Understand Metal Clusters • Understand Structure and bonding of Metal Carbonyls &Metal Nitrosyl • Learn about lsopoly and Heteropoly Acid & salt	
6.	**Credit Value**	**(3L+1T)=04**	
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
1	**Metal ligand Equilibrium in solution**: - Step wise & overall formation constants and their interaction, trends in step wise formation constant, factors affecting the stability of Metal Complexes with reference to nature of metal ion and ligand.	12
II	**Reaction mechanism of transition metal complexes: -** Energy profile of a reaction, reactivity of metal complexes, Inert and labile complexes. Kinetic application of valence bond & crystal field theories. Kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis. Base hydrolysis, Anation reactions, Reactions without metal ligand bond cleavage, substitution reactions in Square planar complexes. The trans effect.	12
III	**Metal Complexes:** (A) Mechanism of the substitution reaction Redox reactions, Electron transfer reactions, mechanism of one electron transfer reaction. **(B) Metal Clusters**- Higher boranes ,carboranes, metalloboranes and metallocarboranes, Metal carbonyl.	12

IV	**(A) Metal Carbonyls:** - Structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls. **(B) Nitrosyl :-** Preparation, bonding, structure & important reactions of transition metal nitrosyl, dinitrogen complexes, tertiary phosphine as ligand.	12
V	**Isopoly and Heteropoly Acid & salt**: Isopoly acids of transition metals Mo, W, V, Nb, Ta. Heteropoly acids and salt of Mo, W, **Structure** of heteropoly acids. .	12

Part C - **Learning Resource**

Reference Books

1. Advanced Inorganic chemistry: - F.A. cotton and wilkinson: John wiley.
2. Inorganic Chemistry : J.E. Huhey, Harpes& Row
3.Chemistry of the elements: N. N. Greenwood,& A Eamshowpergamon.
4. Inorganic Electronic Spectroscopy - A.B.P. Lever, Elsevier
5. Magneto chemistry - R.L. Carlin, Springer Verlag.
6. Comprehensive Co-ordination Chemistry G. Wilkinson, R.D. Gillars and J.A. McCleveftyPergamon.
7. Chemistry Applications of Group Theory - F.A. Cotton.
8. Group Theory: - Bhattacharya.

E-Resources-

1.http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S00005CH/P000658/M026167/ET/1515586461CHE_P3_M17_etext.pdf 2.https://www.dalalinstitute.com/wp-content/uploads/Books/A-Textbook-of-Inorganic-Chemistry-Volume-1/ATOICV1-2-0-Metal-Ligand-Equilibria-in-Solution.pdf

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Part A: Introduction			
Program: M.Sc. Chemistry		Semester: II	w.e.f.:**2023-2024**
1.	Course Code	**CHEMT202**	
2.	Course Title	**Organic Chemistry**	
3.	Course Type	**Theory**	
4.	Pre-requisite (ifany)	**As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur**	
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • To give better knowledge of organicreaction mechanisms. • Specially referred free radical reactions their mechanism. • Better Understanding of synthesis and activity of common heterocyclic compounds. • Use of some reaction of synthetic importance for the purpose of synthesis. • Objective questions practice.	
	Credit Value	**(3L +1T) = 04**	
6.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Electrophilic substitution reactions :-** **(a) Aliphatic electrophilic substitution :-**Biomolecular mechanism : SE^2,SE^1, and SE1 mechanism, electrophilic substitution accompanied by double bond shifts. effect of substrates, leaving group and the solvent polarity on the reactivity. **(b)Aromatic electrophilic substitution-** The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring system. Quantitative treatment of reactivity in substrates and electrophiles, Diazonium coupling, Gattermann Koch reaction, Vilsmeir reaction.	12
II.	**Nucleophilic Substitution reactions :-** **(a) Aliphatic nucleophilicsubstitution :**The SN2, SN1, mixed SN1 and SN2 and SET mechanism. The neighboring group mechanism, neighboring group participation by π and σ bonds. The SN1 mechanism. Nucleophilic substitution at an allylic aliphatic trigonal and at a vinyliccarbon . Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile. **(b)Aromatic Nucleophilicsubstitution :**The SNAr, SN1, benzyne and SRN1 mechanisms, Reactivity-effect of substrate structure. Leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser and Smiles rearrangement. **Concepts in organic synthesis:**Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups. **Free Radical substitution reactions :** Types of free radical reactions, Free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance, Reactivity for aliphatic and aromatic	12

	substrates at a bridge head. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement, Hunsdiecker reaction.	
III.	**Elimination reactions :** The E2, E1 and E1cB mechanism and their spectrum, orientation of double bond. Reactivity- effects of substrate structures, attacking base, the leaving group and the medium. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S)	12
IV.	**Addition to Carbon-Carbon Multiple Bonds :** Mechanism and stereo chemical aspects of addition reactions involving electrophiles, Nucleophiles and Free radicals, regio and chemoselectivity, Orientation and reactivity, Addition to cyclopropane ring. Hydrogenation of double and triple bonds. Hydrogenation of Aromatic rings. Hydroborations Michael reaction, epoxidation. **Addition to Carbon-Hetero Multiple bonds :** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters nitriles. Addition of Grignard's reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds, mechanism of condcnsation reactions involving enolates - Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions, Hydrolysis of ester and amides, Ammonolysis of esters.	12
V.	**Chemistry of natural products:** carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpens and terpenoids. Structure determination of organic compounds by IR, UV-Vis, NMR and Mass spectroscopic techniques.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Reference Books:-

1. Advanced Organic Chemistry - Reaction Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry - F.A. Carey and R.K. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry Peter Syke- longman.
4. Structure and Mechanism in organic chemistry - C.K. Ingold, Cornell University Press.
5. Organic Chemistry - R.T. Morrison and R.N. Boyed ,Prentice - Hall.
6. Modern Organic Reactions H.O. House, Benzamin.
7. Principles of Organic Synthesis - R.P.C. Norman and J.M. Coxon, Blackie Academic and Professional.
8. Reaction Mechanism in Organic Chemistry - S.M. Mukherji and S.P. Singh Macmillan

E-Resources:

https://www.iitpk.com/pdf/Reaction-Mechanisms-GOC-Book.pdf

https://www.researchgate.net/profile/Br-Rajeswara-Rao/post/What-is-the-most-efficient-method-for-extraction-of-phytochemicals-from-plants/attachment/59d6460ec49f478072eae37/AS%3A273831233556481%401442297861959/download/Natural+Products+Chemistry-Cooper%2C+Nicola.pdf

https://www.lehigh.edu/~kjs0/carey-13.PDF

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Part A: Introduction			
Program: M.Sc. Chemistry		Semester: II	w.e.f.:**2023-2024**
1.	Course Code	**CHEMT203**	
2.	Course Title	**Physical Chemistry**	
3.	Course Type	**Theory**	
4.	Pre-requisite (ifany)	**As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur**	
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • **Understand Various concepts of thermodynamics** • **Application of phase rule.** • **Understand statistical thermodynamics and non equilibrium thermodynamics.** • **Learn about concepts of electrochemistry.** • **Understand about Electro catalysis** • **Familiar with various type of diffraction processes.**	
6.	**Credit Value**	**(3L +1T) = 04**	
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**THERMODYNAMICS:**Classical Thermodynamics Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies.'-Partial molar properties, partial molar free energy, partial molar volume and partial molar heat content and their significances. Determinations of these quantities. Concept of fugacity and, determination of fugacity. Non- ideal systems: Excess functions for non-ideal' solutions. Activity, Activity coefficient, Debye-Huckel theory for activity coefficient of' electrolytic solutions, determination of activity and activity coefficients, ionic strength. Application of phase rule to three component systems, second order phase transitions.	12
II.	**Statistical Thermodynamics:**Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging canonical, grand canonical and micro canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions - translational, rotational, vibration and electronic partition functions, calculation of thermodynamicproperties in terms of partition function, application of partition function. Heat capacity behavior of solids - chemical equilibria and equilibriurn constantinterms of partition functions, Fermi-Dirac statistics, distribution law and application to	12

	metals. 'Bose-Einstein Statistics - distribution law and application to helium. **Non Equillbrium Thermodynamics:**Thermodynamic criteria for non-equilibrium state, entropy production and entropy flow, entropy balance equations for different irreversibleprogessls (e,g. heat flow, chemical reaction etc.) transformations of the generalisedfluxes:and forces, nonequilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electro kinetic phenomena, diffusion electric conduction, irreversible thermodynamics for biological system coupled reactions.	
III.	**ELECTROCHEMISTRY:** Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its-extensiqn, solvent interactions, Debye-HuckelJerumrnode. Thermodynamics of electrified interface equations, derivations of electro-capillarity;Lippmann eeuations (surface excess), methods of determination, Structure of electrified interfaces. Guoy-Chapman, Step, Graham-Devanthan - Mottwatts, Tobin, Bockris, Devanathan models. Over potentials, exchange current density, derivation of Butler-Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes- solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces - theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect .oflight a semi-conductor solution interfaces	12
IV.	**Electro-catalysis** - influence of various parameters, Hydrogen electrode. Bioelectrochemistry, threshold membrane phenomena, Nernst-Plank equation. HodgesHuxley equation, core conductor models, electrocardiograph. Polarography theory, llkovic equation, half wave potential and its significance, Introduction to corrosion, homogenous theory, forms of corrosion monitoring and prevention methods.	12
V.	**(a) ELEGTRON DIFFRACTION**-Scattering intensity vs: scattering angle. Wierl equation, measurement technique, Elucidation of structure of sirnple gas phase molecules. Low energy electron diffraction and structure of surface. (b) **NEUTRON DIFFRACTION**-" Scattering of neutron bysolid ' and liquids, Magnetic scattering; Measurement techniques Elucidation ofstructure of magnetically ordered Unit cell	12

Part C - **Learning Resource**
Text Books, Reference Books, E-Resources

Reference Books:-

1. Physcial Chemistry- P.W. Atkins, ELBS
2. Introduction to Quantum Chemsitry-a.K. Chandra, Tata MC Graw Hill
3. Quantum Chemistry- Ira N.Levine, Prentice Hill
4. Coulson's Valence- R. McWeeny, ELBs
5. Chemical Kienties-K.J. Laidler, McGraw Hill
6. Kinetics and mechanism of chemical transformation – J. Rajaram and J. Kuriacose. Mcmillan.
7. Miceles, Theoretical and Applied Aspects- V. Morio, Plenum
8. Modern Electrochemistry Vol.l and II J.O.M. Bockeris and A.K.N. Reddy, Plenum
9. Introduction of Poymer Science- V.R. Gowarikar, N.V.Vishwanathn and J. Sridhar Wiley Easter

E-Resources:

https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000005CH/P000661/M019098/ET/1515647709CHE_P6_M5_etext.pdf

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==

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Part A: Introduction			
Program: M.Sc. Chemistry		Semester: II	w.e.f.: **2023-2024**
1.	Course Code	**CHEMT205**	
2.	Course Title	**PHOTO INORGANIC CHEMISTRY**	
3.	Course Type	**Elective 1 A Theory**	
4.	Pre-requisite (if any)	**As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur**	
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand and apply basics of photochemistry • Evaluate properties of excited states • Understand chemistry of excited states of metal complexes • Explore redox reactions of metal complexes • Investigate chemistry of metal complex sensitizer • Photochemical kinetics calculations • Charge-transfer spectra	
6.	**Credit Value**	**(3L+1T)=04**	
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I	**Basic of Photochemistry :** Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times, Flash photolysis, stopped flow techniques, Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Cordon principle, photochemical states- primary and secondary processes.	12
II	**Properties of Excited States: -** Structure, dipole moment, acid-base strengths, reactivity, photochemical kinetics calculation of rates of radiative processes, Bimolecular deactivation quenching.	12
III	**Excited states of metal complexes:-**Excited states of metal complexes, comparison with organic compounds, electronically excited states of metal complexes, charge-transfer spectra, charge transfer excitations, methods for obtaining charge transfer spectra.	12
IV	**Ligand field Photochemistry:** -Photo-substitution, photo-oxidation and photo-reduction, lability and selectivity. Zero vibrational levels of ground state and excited state, energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states. Metal complex Sensitizers :-Metal complexes sensitizer, electron relay, metal or oxide systems, water photolysis, nitrogen fixation and carbon dioxide reduction.	12

V	**Redox reactions by excited MetalComplexes:** -Energy transfer under conditions of weak interaction and strong interaction, exciplexformation, Conditions of excited states to be useful asredoxreactants, excited electron transfer,Metal complex as attractive candidates(2,2'-bipyridine and 1,10-phenonthroline complexes),illustration of reducing & oxidizing character of Ruthenium2+ (bipyridal complex),comparison with $Fe(bipy)^3$, role of spin-orbit coupling, life time of these complexes. Application of Redox Processes of electronically excited states for catalytic purposes, Transformation of low energy reactants into high energy products ,chemical energy into light.	12

Part C - **Learning Resource**

Reference Books:-

1. Concepts of Inorganic Photochemistry, A.W. Adamson and P.D. Fleischaur, Wiley.
2. Inorganic Photochemistry, J. Chem., Edu.,Vol 60 No.- 10, 198310.Elements of inorganic Photochemistry, G.J.
3. Progress in inorganic Chemistry vol 30ed, S.J. Lippard, Wiley.
4. Coordination Chem. Revs., 1981, Vol 39, 121, 131, 1975, 15, 321, 1990, 97, 313.
5. Photochemistry of Coordination compounds, V. Balzan and V. Carassiti Academic Press.
6.. Elements of Inorganic Photochemistry, G.J. Ferraudi Wiley.

E-Resources:-

1.http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000005CH/P000658/M026167/ET/1515586461CHE_P3_M17_etext.pdf

2.https://www.dalalinstitute.com/wp-content/uploads/Books/A-Textbook-of-Inorganic-Chemistry-Volume-1/ATOICV1-2-0-Metal-Ligand-Equilibria-in-Solution.pdf

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6	Dr. Neeta Gupta Asstt. Prof., Govt. E.R.R. Science College Bilaspur	

Part A: Introduction			
Program: M.Sc. Chemistry		Semester: II	w.e.f.:**2023-2024**
1.	Course Code	**CHEMT206**	
2.	Course Title	**Chemistry of Heterocyclic Compounds**	
3.	Course Type	**Elective 1 B - Theory**	
4.	Pre-requisite (ifany)	As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur	
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Knowledge of synthesis of heterocyclics. • Heterocyclic are equally important in medicinal structures. • After completion of course students will be able for the better understanding of names of medicines having these structure as basic units.	
6.	**Credit Value**	**3L+1T=4**	
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Nomenclature of Heterocycles -** Replacement and systematic nomenclature (Hantzsch-Widmansystem) for monocyclic, fused and bridged heterocycles. **Aromatic Heterocycles -** General chemical behaviour of aromatic heterocycles. Classification (structure type) criteria of aromaticity (bond lengths, ring current andchemical shift in ^{1}H -NMR spectra, Empirical resonance energy, delocalisation energy and Dewar resonance energy, Heteroaromatic reactivity and tautomerism in aromatic heterocycles.	12
II.	**Non aromatic Heterocycles** Strain Bond angle and torsional strain and their consequences in small ring heterocycles. Conformation of six membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1, 3 diaxial interaction, stereo-electronic effect, anomeric effect, Attractive interactions -hydrogen bonding and intermolecular nucleophilic-electrophilic interactions.	12

III.	**Heterocyclic synthesis** Principle of heterocyclic synthesis involving cyclisation reactions and cyclo addition reactions. **Three membered and four membered Heterocycles -** synthesis and reactions of Aziridines, oxirane, thirane, Azetidine, Oxetanes and Thietanes.	12
IV.	**Benzo-fused five membered Heterocycles** Synthesis and reaction including medicinal applications of Benzo-pyrrole, Benzo-furans and Benzo-thiophenes.	12
V.	**Six membered Heterocycles with one Hetero atom** Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium and thiopyrylium salts and pyridones.synthesis and reactions of quinolizinium and Benzopyrilium salts, coumarins and chromones. **Six membered Heterocycles with two or more Hetero atoms** Synthesis and reactions of diazines, Triazines, Tetrazines and Thiazines. **Seven and large membered Heterocycles** Synthesis and reaction of azepines, oxepines, thiepines, diazepines, Thiazepines.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Reference Books:-

1. Heterocyclic Chemistry by J.A. Joule, K. Mills and G.F. Smith, Chapman & Hall
2. Heterocyclic Chemistry by T.L. Gilchrist, Longman Scientific Technical.
3. An Introduction to Heterocyclic Chemistry by R.M. Acheson, John Wiley.
4. Organic Chemistry Vol. II by I.L. Finar, ELBS
5. Rodds Chemistry of Carbon Compounds Ed. S. Coffery, Elsevier
6. Natural Products chemistry and Biological Significance by J. Mann, R.S. Davidson, J.B. Hobbs, J.B. harborne, Longman, Essex.
7. Heterocyclic Chemsitry, Vol. 1 to 3, by R.D. Gupta, ...Kumar and V. Gupta, Springer Verlog

8. Chemistry of Heterocycles, by T. Eicher and S. Hanpalmann, Thieme
9. Contemporary Heterocyclic Chemistry by G.R. Newkome, and W.W. Pandler, Wiley Interscience

E-Resources:

http://kgut.ac.ir/useruploads/1615027155168dde.pdf

https://www.uou.ac.in/lecturenotes/science/MSCCH-17/CHEMISTRY%20LN.%203%20HETEROCYCLIC%20COMPOUNDS-converted%20(1).pdf

Sr. No.	Chemistry, B.O.S. Chairman/Member's Name	Signature
1	Mr. L.C. Manwani Asstt. Prof., Dr. B.S. Porte Govt. College, Pendra	1-8-22
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अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

कोनी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009

Website :www.bilaspuruniversity.ac.in

Part A: Introduction			
Program: M.Sc. Chemistry	Semester: II		w.e.f.:2023-2024
1.	Course Code	CHEMT207	
2.	Course Title	**Chemistry of Materials**	
3.	Course Type	**Theory**	
4.	Pre-requisite (ifany)	As per Rules of Atal Bihari Vajpayee Vishwavidyalaya Bilaspur	
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to understand:** • Solid state reaction • Powder compact reactions &Solid state defects • Electronic properties & Band theory • Solid Electrolytes • Magnetic & Optical Properties of Solids	
6.	**Credit Value**	**3L+1T=4**	
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**

Part B: Content ofthe Course

Unit	Topics	Total Hours
I.	**SOLID STATE REACTIONS PREPARATIVE METHODS:** Vapor phase transport, preparation of thin films - electrochemical methods,chemical vapour deposition; Crystal growth - Bridgman &Stokbarger methods, zone melting.Characterization of Solids: Crystal diffraction of X-rays, X-ray diffraction method; Powdermethod – principles and uses; Scattering of X-rays by crystals – systematic absences; Electrondiffraction; Neutron diffraction.	12
II.	**POWDER COMPACT REACTIONS AND SOLID-STATE DEFECTS:** Diffusion Model, Parabolic rate law, Jander's rate equation, Kroger-Zeigler equation, Ginstling- Brounshtein rate equation. Stoichiometric Defects: Equilibrium concentration of point defects in crystals - Schottky defects, Frenkel defects; The photographic process - light sensitive crystals, mechanism of latent image formation, lithium iodide battery. Non-Stoichiometric Defects: Origin of nonstoichiometry, consequences of non-stoichiometry; Equilibria in non-stoichiometric solids, Colorcenters: F-centre, electron and hole centre; colourcentre and informationand hole centre; colourcentre and information	14
III.	**ELECTRONIC PROPERTIES AND BAND THEORY** : Metals insulators and semiconductors,electronic structure of solids band theory,band structure of metals, insulators and semiconductors,doping semiconductors, p-n junction, super conductor.electrically conducting solids, organic charge transfer complex organic metals, new super conductors.	10

IV.	**SOLID ELECTROLYTES TYPICAL IONIC CRYSTALS:** Alkali metal halides (vacancy conduction), silver chloride (interstitial conduction); Solid Electrolytes - β-alumina, silver iodide, halide and oxide ion conductors; Application of Solid Electrolytes. Fuel cells: electrochemical power generator (hydrogen-oxygen cell, Solid state Galvanic cell); Thermoelectric Effects: Seebeck effect; Hall Effect.	12
V.	**MAGNETIC AND OPTICAL PROPERTIES OF SOLIDS:** Behaviour of substances in magnetic field; Effects of temperature (Curie & Curie-Weiss laws); Magnetic moments; Mechanism of ferro- and antiferromagnetic ordering – super exchange. Luminescence and phosphors; Configurational coordinate model, Antistoke phosphors, Lasers — ruby and neodymium. Conducting Organics: Organic conductors, preparation, mechanism of conduction in organic semiconductors, photoconductivity of polymers.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Reference Books:-

1 A. R. West. Solid State Chemistry and its Applications, John Wiley (1987).
2. F. Gutmann& L.E. Lyons. Organic Semiconductors, John Wiley (1987).
3. N. B. Hannay, Solid State Chemistry, Prentice Hall of India (1979)

E-Resources:

http://kgut.ac.ir/userupload s/1615027155168dde.pdf

https://www.uou.ac.in/lecturenotes/science/MSCCH-17/CHEMISTRY%20LN.%203%20HETEROCYCLIC%20COMPOUNDS-converted%20(1).pdf

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M.Sc. II SEMESTER			
Part-A: Introduction			
Program: Certificate Course		**Session-2023-24**	
1.	Course Code	**CHEMP202**	
2.	Course Title	**LAB-4 PROJECT WORK**	
3.	Course Type	**Laboratory Course (PROJECT WORK)**	
4.	Pre-requisite (if any)	**As per Atal Bihari Vajpayee Vishwavidyalaya Bilaspur Rules**	
5.	Course Learning Outcome(CLO)	At the end of this course, the students will be able to learn the following aspects of Chemistry through practical exercises in	
		• Inorganic Chemistry • Organic Chemistry • Physical Chemistry • Analytical Chemistry	
6.	Credit Value	02	
7.	Total Marks	Max. Marks:100	Min.-36

Part-B: Content of Course	
Group of students will select one of the project work as per given by subject teacher and should be completed with systematic reporting.	
	Distribution of Marks- **Introduction 10** **Literature survey 10** **Material &Methods 50** **Discussion of Results20** **Conclusion 10**
Total Marks-100	

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