SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Faculty of Science

(FOS)

Department of Chemistry

CURRICULUM

for

Master of Science (*M.Sc*) in Chemistry

PROGRAM CODE: FOSMSC2CHE

Master of Science (M.Sc) in Chemistry-2 Years

Department of Chemistry, Faculty of Science

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Shri Davara University, Naya Raipur
Semester-II
(Effective Session: 2024-25)

CourseType	CourseCode	CourseTittle	LTP Ratio				Assessment Marks		
			L	T	P	Credits	Formative	Summative	Total
Semester-II									
DSC	MSCCH201	Inorganic Chemistry II: Transition Metal Complexes	3	2	-	5	30	70	100
DSC	MSCCH202	Organic Chemistry II: Reaction Mechanism	3	2	-	5	30	70	100
DSC	MSCCH203	Physical Chemistry II:Quantum Chemistry, Thermodynamics And Chemical Dynamics-II	3	2	-	5	30	70	100
DSE	MSCCH204	Theory and Application of Spectroscopy II	3	2	-	5	30	70	100
Practical	MSCCH205	Chemistry Lab Course: III			4	2	15	35	50
Practical	MSCCH206	Chemistry Lab Course: IV			4	2	15	35	50
GE	MSCCH207	Research Methodology	2	-	-	2	15	35	50
	Total		**14**	8	8	26			**550**

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Title	**INORGANIC CHEMISTRY II:TRANSITION METAL COMPLEXES**				
Code	**MSCCH201**				
Credit	**L**	**T**	**P**	**TC**	
	3	2	-	5	
Prerequisite	**Inorganic Chemistry II**				
Objective	**Inorganic Chemistry in advance and establish foundation to research in the respective domain.**				
Content	**UNIT 1** **Reaction Mechanism of Transition Metal Complexes:** Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anion reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and marcus-hush theory, inner sphere type reactions. **UNIT II** **Electronic Spectral and Magnetic Properties of Transition MetalComplexes:** Spectroscopic ground states, correlation. orgel and tanabe-sugano diagrams for transition metal complexes (d1-d9 states), selection rule for electronic spectroscopy. Intensity of various type electronic transitions, calculations of 10Dq, B and β parameters, charge transfer spectra. Anomalous magnetic moments, quenching of orbital contribution, orbital contribution to magnetic moment, magnetic exchange coupling and spin crossover. **UNIT III** **Transition Metal Complexes**:Tranisition metal complexes with unsaturated				

	organic molecules, alkanes,allyl,dienedienyl,arene and trienylcomplex,preparations,properties,nature of bonding and structure features.Important reaction relating to nucleophilic and electrophilic attack on ligands and organic synthesis. Transition metals compound with bond to hydrogen. **UNIT IV** **Alkyls Andaryls of Transition Metals:** Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis. **Compounds of Transition Metal-Carbon Multiple Bonds:** Alkylidenes, low valentcarbenesnature of bond and Structural characteristics. **Fluxional Organometallic Compounds:** Fluxionality and dynamic equilibria in compounds such as olefin, -allyl and dienyl complexes. **Organocatalysis**: General Principles: Energetic, Catalytic cycles, catalytic efficiency and life time, selectivity. Type of organometallic reaction: Ligand substitution, Oxidative addition, reductive elimination and insertion and deinsertion. Homogeneous catalysis: Hydrogenetion of alkenes, Hydroformylation, Monsanto acetic acid synthesis, Wacker oxidation of alkenes, Alkenes metathesis, Palladium-Catalysed C-C bond forming reactions, asymmetric oxidation. Heterogenous catalysis: The nature of heterogenous catalysts, Fischer- Tropsch synthesis, alkene polymerization
Outcome	On the completion of this course successfully student will be able to understand the development of the inorganicchemistry.
Text Books	1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley. 2. Inorganic Chemistry, J.E. Huhey, Harpes and Row. 3. Chemistry of the Elements, N.N. Greenwood and A. Earnshow, Pergamon. 4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
Reference Books	1. Comprehensive Coordination Chemistry Eds. G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon. 2. Magnetiochemistry, R.1. Carlin, Springer Verlag. 3. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty,Pergamon. 4. Advance Inorganic Chemistry,S.K. Agrawal& K. Lal, PragatiPrakashan

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Title	**ORGANIC CHEMISTRY II:REACTION MECHANISM**				
Code	**MSCCH202**				
Credit	**L**	**T**	**P**	**TC**	
	3	2	-	5	
Prerequisite	**Organic Chemistry: II**				
Objective	**Organic Chemistry in advance and establish foundation to research in the respective domain.**				
Content	**UNIT I** **Reaction Mechanism**: Structure and Reactivity Type of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtir-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotopes effects. Hard and Soft acids and bases. Effect of structure on reactivity resonance and field effects, steric effect, Hammett equation and linear free energy relationship, substitution and reaction constants. **UNIT II** **Aliphatic Nucleophilic Substitution**: The SN2, SN1, mixed SN1 and SN2 and SET mechanisms. The neighboring group mechanism, neighboring group participation by □ and □ bonds. The SNi mechanism. Nucleophilic substitution at an allylic aliphatic trigonal and at a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, amoident nucleophile, regioselectivity. **Aromatic Nucleophilic Substitution**: The SNArSN1, benzyne and SN1 mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richte, Sommelet-Hauser and Smiles rearrangements **UNIT III** **Alipahatic Electrophilic Substitution**: Bimolecular mechanism SE2, SEi and SEI mechanism electrophilic substitution acompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.				

	Aromatic Electrophilic Substitution: The treniumion mechanism, orientation and reactivity, energy profile diagrams. The ortholpara ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Gatterman-Koch reaction, Vilsmeir reaction. **UNIT IV** **Addition to Carbon-Hetero:** Multiple bonds mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acid esters and nitriles. Addition of grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Witting reaction. Mechanism of condensation reactions involving enolates-aldol, knoevenagel, claisen, mannich, benzoin, perkin and stobbe reactions. Hydrolysis of esters and amides, ammonolysis of ester. **Addition to Carbon Multiple** bonds addition to cyclopropane ring. hydrogenation of double and triple bounds, hydrogenation of aromatic rings. hydroboration, michael reaction, sharpless asymmetric epoxidation. **Elimination Reactions** The E2, E1 and E1cB mechanisms and their spectrum. Orientation of the double bond. Reactitivty-effects of substrate structures, attacking base, the leaving group and the medium.
Outcome	On the completion of this course successfully student will be able to understand the development of the organic chemistry.
Text Books	1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley. 2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum. 3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman. 4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press. 5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.

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Reference Books	1. Modern Organic Reactions, H.O. House, Benjamin. 2. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic &Professionsl. 3. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan. 4. Pericyclic Reactions, S.M. Mukherji, Macmillan, India 5. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

<table>
<tr><td>Title</td><td colspan="5">PHYSICAL CHEMISTRY II:QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS-II AND SOLID STATE</td></tr>
<tr><td>Code</td><td colspan="5">MSCCH203</td></tr>
<tr><td rowspan="2">Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>2</td><td>-</td><td>5</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Physical Chemistry: II</td></tr>
<tr><td>Objective</td><td colspan="5">Physical Chemistry in advance and establish foundation to research in the respective domain.</td></tr>
<tr><td>Content</td><td colspan="5">UNIT I
Angular Momentum: Ordinary angular momentum, generalized angular momentum, eigen functions for angular momentum, eigenvalues of angular momentum operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.
Molecular Orbital Theory:Huckel theory of conjugated systems bond and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical cyclobutadiene etc. Introduction to extended huckel theory.
UNIT 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-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition. Application of partition functions. Fermi-Dirac Statistics, distribution law and applications to metal. Bose-Einstein statistics distribution Law and application to helium.
UNIT III
Chemical Dynamics II: General featuresof fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis ad the nuclear magnetic resonance method, dynamics of unimolecular reactions (Lindemann</td></tr>
</table>

	Hinshelwood and RiceRamsperger-Kassel- Marcus (RRKM) theories for unimolecular reactions). **Electrochemistry II:** Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface Electrocatalysis - influence of various parameters. Hydrogen electrode. **UNIT IV** **Macromolecules Polymer:** definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures. **Crystal Defects and Non-Stoichiometry:** Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkeldefect formation, colourcentres, non-stoichiometry and defects. **Electronic Properties and Band Theory:** Metals insulators and semiconductors, electronic structure of solid band theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties - Optical reflectance, photoconduction photoelectric effects.
Outcome	On the completion of this course successfully student will be able to understand the development of the physical Chemistry.
Text Books	1.Physical Chemistry, P.W. Atkins, ELBS. 2. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill. 3. Quantum Chemistry, Ira N. Levine, Prentice Hall. 4. Coulson's Valence, R.McWeen y, ELBS.
Reference Books	1. Chemical Kinetics. K.J. Laidler, McGraw-Hill. 2. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, McMillan. 3. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.

	4. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum. 5. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.

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<table>
<tr><td>Title</td><td colspan="5">THEORY AND APPLICATION OF SPECTROSCOPY II</td></tr>
<tr><td>Code</td><td colspan="5">MSCCH204</td></tr>
<tr><td rowspan="2">Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>2</td><td>-</td><td>5</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Students must appears in end semester examination of M.Sc. Chemistry with Theory and Application of Spectroscopy I</td></tr>
<tr><td>Objective</td><td colspan="5">Spectroscopy Chemistry in advance and establish foundation to research in the respective domain.</td></tr>
<tr><td>Content</td><td colspan="5">UNIT I
Ultraviolet and Visible Spectroscopy:
Introduction, intensity of vibrational-electronic spectra and Frank-Condon principle for dissociation energy, rotational fine structure of electronic-vibrational spectra, Shape of some molecular orbitals viz., H_2, He_2, N_2, O_2. Electronic spectra of organic molecules, chromophores, application of electronic spectroscopy: spectrophotometric studies of complex ions, determination of ligand/metal ratio in a complex, identification of compounds, determination stability constants.
UNIT II
Infra red Spectroscopy:
Introduction, simple and anharmonic oscillators in vibrational spectroscopy, diatomic-vibrating rotator, Modes of vibration in polyatomic molecules, vibration-coupling, Fourier Transform IR spectroscopy: instrumentation, interferometric spectrophotometer, sample handling,Factors influencing vibrational frequencies, Application of IR spectroscopy: Interpretation of IRspectraof normal alkanes, aromatic hydrocarbons, alcohols and phenols aldehydes and ketones, ethers, esters, carboxylic acids and amines and amides
UNIT III
Mass Spectrometry:
Introduction, basic principles, separation of the ions in the analyzer, resolution, molecular ion peak, mass spectral fragmentation of organic compounds, factors</td></tr>
</table>

	affecting fragmentation, McLafferty rearrangement. Instrumentation, Characteristics of mass spectra of Alkanes, Alkenes, Aromatic hydrocarbons, Alcohols, Amines. Nitrogen rule, ring rule, Molecular weight and formula determination, Gas chromatography-Mass spectrophotometry: Introduction. **UNIT IV** **Nuclear Resonance Spectrophotometry:** Theory of NMR spectroscopy, interaction of nuclear spin and magnetic moment, chemical shift, processional motion of nuclear particles in magnetic field, spin-spin splitting, coupling constants, factor affecting the chemical shift, shielding effect, effect of chemical exchange, hydrogen bonding, instrumentation of Fourier transform NMR spectrophotometer, structure determination of organic compounds, Carbon-13 NMR spectroscopy, Multiplicity-proton (1H) decoupling-noise decoupling, offresonance decoupling, selective proton decoupling, chemical shift. **Electron Spin Resonance Spectroscopy:**Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as PH4, F2 and [BH3] . **Mossbauer Spectroscopy:**Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and sn^{+4} compounds - nature of M-L bond, -coordination number, structure and (3) detection of oxidation state and in equivalent MB atoms
Outcome	On the completion of this course successfully student will be able to understand the development of the spectroscopy.
Text Books	1. Modern Spectroscopy, J.M. Hollas, John Viley. 2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience. 3. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood. 4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
Reference	1. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill.

Books	2. Basic Principles of Spectroscopy, R. Chang, McGraw Hill. 3. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford. 4. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley. 5. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, harper & Row.

Title	**CHEMISTRY LAB COURSE:III**				
Code	**MSCCH205P**				
Credit	**L**	**T**	**P**	**TC**	
	0	**0**	**2**	**2**	
Prerequisite	**Chemistry Lab Course:I**				
Objective	**To understand the practical concepts of inorganic and organic chemistry**				
Content	1. Simple distillation, steam distillation, fractional distillation and distillation under reduced pressure. 2. General methods of separation and purification of organic compounds with special reference to: a. Solvent Extraction b. Fractional Crystallisation Distillation techniques 3. Analysis of organic binary mixture: Separation and Identification of organic binary mixtures containing at				

	least one component with two substituents. (A student is expected to analyse at least 10 different binary mixtures.) 4. Preparation of organic compounds single stage preparation (Any five). a. Acetylation: Synthesis of β-Naphthyl acetate from β-Naphthol / Hydroquinonediacetate from Hydroquinone. b. Aldol condensation: Dibenzal acetone from benzaldehyde. c. Bromination: p-Bromoacetanilide from acetanilide. d. Cannizzaro Reaction: Benzoic acid and Benzyl alcohol from benzaldehyde. e. Friedel Crafts Reaction: O-Benzoyl Benzoic acid from phthalic anhydride. f. Grignard Reaction: Synthesis of triphenylmethanol from benzoic acid. g. Oxidation: Adipic acid by chromic acid oxidation ofcyclohexanol. h. Perkin's Cinnamic Reaction: acid from benzaldehyde. i. Sandmeyer Reaction: p-Chlorotoluene from p-toluidine/o-Chlorobenzoic acid from anthranilic acid. j. Schotten Baumann Reaction: β-Naphthyl benzoate from:β-Naphthol / Phenyl benzoate from phenol. Sulphonation Reaction: Sulphanilic acid from aniline.
Outcome	On the completion of this course successfully student will be able to understand practical of inorganic chemistry and organic chemistry. .
Text Books	1. Vogel's Textbook of Quantitative Analysis, revi Mendham, ELBS. 2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly, Prentice Hall. 3. Practical Organic chemistry by A. I. Vogel. 4. Practical Organic chemistry by Mann and Saunders. 5. Practical Organic chemistry by Garg and Salija.
Reference Books	1. The Systematic Identification of Organic compounds, R. L. Shriner and D. Y. Curtin.

	2. Semimicro Qualitative Organic Analysis, N.D. Cheronis, J. B. Entrikin and E. M. Hodnett. 3. Practical Physical chemistry by Alexander Findlay. 4. Experimental Physical chemistry, D. P. Shoemaker, G. W. Garland and J. W. Niber, McGraw Hill Interscience. Findlay's Practical Physical chemistry, revised B

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Title	**CHEMISTRY LAB COURSE:IV**				
Code	**MSCCH206P**				
Credit	**L**	**T**	**P**	**TC**	
	0	**0**	**2**	**2**	
Prerequisite	**Chemistry Lab Course:II**				
Objective	**To understand the practical concepts of spectroscopy and physical chemistry**				
Content	1. Flame photometric determinations a. Sodium and potassium when present together. b. Sodium/potassium in solid samples. c. Solid Sodium and Potassium in Liquid Samples. d. Lithium/calcium/barium/strontium. e. Cadmium and magnesium in tap water. 2. Nephelometric determinations 1. Sulphate 2. Phosphate 3. Silver 3. Spectroscopy a. Verification of Beer's Lambert Law. b. Determination of stoichiometry and stability constant of inorganic (e.g. ferric –salicylclic acid) and organic (e.g. amine-iodine) complexes, thiocynam. c. Characterization of the complexes by electronic and IR, UV spectral data. Determination of Indicator constant (pKa) of methyl redin (i) aqueous and (ii) micellar media.				

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Outcome	On the completion of this course successfully student will be able to understand practical knowledge of physical chemistry, spectroscopy and analytical chemistry practical laboratory work.
Text Books	1. Experiments and Techniques in Organic Chemistry, D.Pasto, C. Johnson and M.Miller, Prentice Hall. 2. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Heath. 3. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold. Handbook of Organic Analysis –Qualitative and Quantitative, H. Clark, Adward Arnold. 4. Vogel's Textbook of Practical Organic Chemistry, 5. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
Reference Books	1. Findley's Practical Physical Chemistry, B.P. Levi 2. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill. 3. Computer and Common Sense, R. Hunt and J. Shelley, Prentice Hall. 4. Computational Chemistry, A.C. Norris. 5. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger. 6. Computer Programming in FORTRAN IV, V. Rajaraman, Prentice Hall. 7. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall. 8. Experiments in Chemistry, D.V. Jahagirgar.

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

<table>
<tr><td>Title</td><td colspan="5">RESEARCH METHODOLOGY</td></tr>
<tr><td>Code</td><td colspan="5">MSCSE207</td></tr>
<tr><td rowspan="2">Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>2</td><td>-</td><td>-</td><td>2</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Students must appears in end semester examination of M.Sc. Chemistry</td></tr>
<tr><td>Objective</td><td colspan="5">Research Methodology for Chemistry in advance and establish foundation to research in the respective domain.</td></tr>
<tr><td>Content</td><td colspan="5">UNIT I Research: An Introduction
a) Types of Scientific Methods: Hypothetic-Deductive and Inductive Research
b) Types of Research: Basic vs. Applied, Quantitative vs. Qualitative Research
c) Principles of a Good Research
UNIT II The Research Process
a) Stages of conducting a Research
b) Problem and Hypothesis: Definition, Types
c) Variables: Types, Operational definition
. UNIT III Behavioural Research I
a) Control of Extraneous Variables
b) Laboratory experiments, Field Experiments
c) Field study, Survey
UNIT IV Behavioural Research II
a) Research: Causality and It’s criteria
b) Threats to Internal and External Validity
c) Non-Experimental Research: Co-relational Research, Survey
d) Sampling Issues: Representativeness and Adequacy
e) Sampling Strategies: Probability and Non-probability Sampling, Sampling Errors
f) Demand Characteristics and Ethical issues in Research</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course aims to enable the students learn the concepts of Research techniques and it’s applicability in the various minor and major researches. Fundamentals of research with specific reference to quantitative research methods would facilitate the students towards exploring the area of their interest.</td></tr>
</table>

Outcome	The course aims to enable the students learn the concepts of Research techniques and it's applicability in the various minor and major researches. Fundamentals of research with specific reference to quantitative research methods would facilitate the students towards exploring the area of their interest.
Books Recommended:	Aronson, E. and Ellsworth D.C., Carlsmith, J.M., Gonzales, M.I

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Faculty of Science

(FOS)

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CURRICULUM

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Master of Science (*M.Sc*) in Chemistry

PROGRAM CODE: FOSMSC2CHE

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Master of Science (M.Sc) in Chemistry-2 Years

Department of Chemistry, Faculty of Science

Shri Davara University, Naya Raipur

Semester-I

(Effective Session: 2024-25)

CourseType	CourseCode	CourseTittle	LTP Ratio				Assessment Marks		
			L	T	P	Credits	Formative	Summative	Total
Semester-I									
DSC	MSCCH101	Inorganic Chemistry I:Chemistry of Metal Complexes and Group Theory	3	2	-	5	30	70	100
DSC	MSCCH102	Organic Chemistry I: Concept in Organic Chemistry	3	2	-	5	30	70	100
DSC	MSCCH103	Physical Chemistry I: Quantum Chemistry, Thermodynamics and Chemical Dynamics-I and Surface Chemistry	3	2	-	5	30	70	100
DSE	MSCCH104	Theoryand Application of Spectroscopy I	3	2	-	5	30	70	100
Practical	MSCCH105	Chemistry Lab Course: I			4	2	15	35	50
Practical	MSCCH106	Chemistry Lab Course: II			4	2	15	35	50
GE	MSCCH107	Computer Fundamental and MS Office	2	-	-	2	15	35	50
	Total		**14**	8	8	26			**550**

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

<table>
<tr><td>Course Title</td><td colspan="5">INORGANIC CHEMISTRY I:CHEMISTRY OF METAL COMPLEXES AND GROUP THEORY - DSC</td></tr>
<tr><td>Course Code</td><td colspan="5">MSCCH101</td></tr>
<tr><td rowspan="2">Course Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>2</td><td>-</td><td>5</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Students must have the knowledge of periodic properties of elements and their application.</td></tr>
<tr><td>Course Objective</td><td colspan="5">• Inorganic Chemistry in advance and establish foundation to research in the respective domain.</td></tr>
<tr><td>Content</td><td colspan="5">UNIT-I
Stereochemistry and Bonding in Main Group Compounds:VSEPR, Walsh diagram (triatomic and penta-atomic molecules), dribonds, bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.
Metal-Ligand: Equilibrium in solution stepwise and overall formation constants and their interaction, trends in stepwise constant, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand. Chelate effect and its thermodynamic origin, determination of binary formation constants by potentiometry and spectrophotometry.
UNIT-II
Metal-Ligand Bonding Limitation of Crystal Field Theory, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.
Metal –Complexes: Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reaction of transition metal nitrosyl, dinitrogen and dioxgen complexes; tertiary phosphine as ligand.
UNIT-III
Isopoly and Heteropoly Acid: Isopoly and heteropoly acids of Mo and W. Preparation, properties and structure. Classification, Preparation, properties and</td></tr>
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	structures of borides, carbides, nitrides and silicides. Silicates- classification and Structure, Silicones- preparation, properties and application. **UNIT- IV** **Metal Clusters:** Higher boranes, carboranes, metalloboranes and metallo-carboranes compounds with metal metal multiple bonds. Crown ether complexs and cryptands, inclusion compounds **Chains:** catenation, heterocatenation, intercatenation. **Rings:** Borazines, phosphazines. **Symmetry and Group Theory in Chemistry**:Symmetry elements and symmetry operation, definition of group, subgroup., reaction between orders of a finite group and its sub-group, Conjugacy relation and classes. Point symmetry group. Schonfilies symbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy.
Course Outcome	• On the completion of this course successfully student will be able to understand the development of the inorganicchemistry.
Text Books	1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley. 2. Inorganic Chemistry, J.E. Huhey, Harpes and Row. 3. Chemistry of the Elements, N.N. Greenwood and A. Earnshow, Pergamon. 4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier. 5. Comprehensive Coordination Chemistry Eds. G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.
Reference Books	1. Magnetiochemistry, R.1. Carlin, Springer Verlag. 2. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty,Pergamon. 3. Advance Inorganic Chemistry,S.K. Agrawal& K. Lal, PragatiPrakashan

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

Course Title	**ORGANIC CHEMISTRY I:CONCEPT IN ORGANIC CHEMISTRY AND PHOTOCHEMISTRY - DSC**				
Course Code	**MSCCH102**				
Course Credit	**L**	**T**	**P**	**TC**	
	3	**2**	**-**	**5**	
Prerequisite	Students musthave the knowledge of nomenclature and isomerism of organic molecules				
Course Objective	• Organic Chemistry in advance and establish foundation to research in the respective domain.				
Course Content	**UNIT-I** **Nature of Bonding in Organic Molecules:**Delocalized chemical bonding-conjugation, cross conjugation, resonance,hyperconjugation, bonding in fullerences, tautomerism. **Aromaticity**: Aromacityinbenzenoid and non-benzoid compounds, alternate and non-alternate hydrocarbons. Huckel's rule, energy. Level of π-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds, **UNIT-II** **Conformational:** analysis of cycloalkanes, decalins, effect of confirmation of reactivity, confirmation of sugars, steric strain due to unavoidable crowding **Stereochemistry:** Elements of symmetry, chirality, molecules with more than one chiral center, threo and ertythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereo selective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spirane chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus. **UNIT -III** **Reaction intermediates**: Generation, structure, stability and reactivity of carbocation~carbanions, free radicals, carbenes, Nitrenes, and Benzynes. Application of NMR in detection of carbocations.				

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	Free Radical Reactions: Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboyxlic acids, autooxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, sandmeyer reaction, free radical rearrangement andhunsdiecker reaction. **UNIT-IV** **Pericyclic Reactions:** Molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1,3,5hexatriene and allyl system. Classification of periycyclic reactions, woodward-hoffmann correlation diagrams, FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, 4n 4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotrpic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties, 3,3- and 5,5 sigmatropic rearrangements, claisen, cope and aza-cope rearrangements, fluxional tautomerism and enereaction. **Photochemical Reactions:-**Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum field, transfer of excitation energy, actinometry. **Determination of ReactionMechanism**Classification, rate constants and life times of reactive energy state determination of rate constants of reactions, Effect of light intensity on the rate of photochemical reactions, Types of photochemical reactions-photo dissociation, gas-phase photolysis. **Miscellaneous Photochemical Reactions**:- Photo-Fries reactions of annelids, Photo-Fries rearrangement, Barton reaction, Singlet molecular oxygen and its reactions, Photo-chemical formation of smog, Photo- degration of polymers, Photochemistry of vision. Photo chemistry of Aromatic Compounds- Isomerisations, additions and substitutions
Course Outcome	On the completion of this course successfully student will be able to understand the development of the organic chemistry.
Text Books	1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry

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	March, John Wiley. 2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum. 3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman. 4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press. 5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall. 6. Modern Organic Reactions, H.O. House, Benjamin.
Reference Books	1. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic &Professionsl. 2. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan. 3. Pericyclic Reactions, S.M. Mukherji, Macmillan, India 4. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International. 5. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International

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<table>
<tr><td>Course Title</td><td colspan="5">PHYSICAL CHEMISTRY I: QUANTUM CHEMISTRY THERMODYNAMICS AND CHEMICAL DYNAMICS – I AND SURFACE CHEMISTRY - DSC</td></tr>
<tr><td>Course Code</td><td colspan="5">MSCCH103</td></tr>
<tr><td rowspan="2">Course Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>2</td><td>-</td><td>5</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Students must have the basic knowledge of general physical chemistry and calculus.</td></tr>
<tr><td>Course Objective</td><td colspan="5">• Physical Chemistry in advance and establish foundation to research in the respective domain.</td></tr>
<tr><td>Course Content</td><td colspan="5">UNIT-I
Introduction to Exact Quantum Mechanical: Results The Schrödinger equation and the postulates of quantum mechanics. Discussion of solutions of the schrödinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom and helium atom.
Approximate Methods: The variation theorem, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the helium atom.
UNIT-II
Classical Thermodynamics: Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity.
Non-ideal systems: Excess function s for non-ideal solutions, activity, activity coefficient, debyehuckel theory for activity coefficient of electrolytic solutions, determination of activity and activity coefficients, ionic strength. Application of phase rule.
UNIT-III
Chemical Dynamics I: Methods 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</td></tr>
</table>

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	kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogenbromine and hydrogen-chlorine reactions) and oscillatory reactions (Belousov - Zhabotinskyreaction). **UNIT-IV** **Electrochemistry I:** Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces. Guoy-Chapman, Stern, Graham-Devanathan-Mottwatts, Tobin, Bockris, Devanlhan models. Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. **Adsorption:** Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon) catalytic activity at surface. **Micelles:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solublization, micro emulsion, reverse micelles.
Course Outcome	• On the completion of this course successfully student will be able to understand the development of the physical Chemistry.
Text Books	1. Physical Chemistry, P.W. Atkins, ELBS. 2. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill. 3. Quantum Chemistry, Ira N. Levine, Prentice Hall. 4. Coulson's Valence, R.McWeen y, ELBS. 5. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
Reference Books	1. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, McMillan. 2. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum. 3. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N.

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	Reddy, Planum. 4. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.

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<table>
<tr><td>Course Title</td><td colspan="5">THEORY AND APPLICATION OF SPECTROSCOPY: I- DSE</td></tr>
<tr><td>Course Code</td><td colspan="5">MSCCH104</td></tr>
<tr><td rowspan="2">Course Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>2</td><td>-</td><td>5</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Students must have the knowledge of interaction between light and matter and quantum mechanics.</td></tr>
<tr><td>Course Objective</td><td colspan="5">• Spectroscopy Chemistry in advance and establish foundation to research in the respective domain.</td></tr>
<tr><td>Course Content</td><td colspan="5">UNIT -I
Unifying Principles: Electromagnetic radiation, interaction of electromagnetic radiation with matterabsorption, emission transmission, reflection, dispersion, polarization and scattering, Uncertainty relation and natural line width and natural line broadening, transition probability, selection rules, intensity of spectral lines, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels.
UNIT -II
Microwave Spectroscopy:Classification of molecules in term of their internal rotation mechanism, determination of rotation energy of diatomic and polyatomic molecules, intensities of rotational spectral lined, effect of isotopic substitution on diatomic and polyatomic molecules, intensities of rotational spectral lines and parameters of rotational energy of linear and the transition frequencies, non-rigid rotators, spectral lines and parameters of rotational energy of linear and symmetric top polyatomic molecules. Application in determination of bond length.
UNIT- III
Scattering Spectroscopy:
Principle, instrumentations and application of Auger spectroscopy and Scanning Electron Microscopy for chemical characterization, electron diffraction of gases and vapours, The Wierl equation and co- related method, application of electron diffraction.
Theory, instrumentation and application of turbidimetry, nephelometry and fluorometry. Fluoroscence and phosphorescence and factors affecting them.</td></tr>
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	UNIT –IV Raman Spectroscopy: Classical and quantum theories of Raman effect, pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules mutual exclusion principle, Resonance Raman spectroscopy, Coherent anti Stokes Raman spectroscopy (CARS), Instrumentation , Application of Raman effect in molecular-structures, Raman activity of molecular vibration, structure of CO_2, N_2O, SO_2, NO_3 , CIF_3 **X-ray Diffraction:** Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules, Ramcharan diagram. **Electron Diffraction:** Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces. **Neutron Diffraction :**Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell.
Course Outcome	• On the completion of this course successfully student will be able to understand the development of the spectroscopy.
Text Books	1. Modern Spectroscopy, J.M. Hollas, John Viley. 2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience. 3. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood. 4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
Reference Books	1. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill. 2. Basic Principles of Spectroscopy, R. Chang, McGraw Hill. 3. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford. 4. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley. 5. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, harper & Row.

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<table>
<tr><td>Course Title</td><td colspan="5">CHEMISTRY LAB COURSE:I</td></tr>
<tr><td>Course Code</td><td colspan="5">MSCCH105P</td></tr>
<tr><td rowspan="2">Course Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>2</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Students must have the practical knowledgeof chemical analysis forinorganic and organic molecules.</td></tr>
<tr><td>Course Objective</td><td colspan="5">• To understand the practical concepts of inorganic and organic chemistry</td></tr>
<tr><td>Course Content</td><td colspan="5">A. Inorganic Chemistry
1. Qualitative analysis of mixture containing eight radical including two less common metal from among the following by semi micro method.
Basic Radicals : Ag, Pb, Hg, Bi, Cu, Cd, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, Ce, Th, Zr, W, Te, Ti, Mo, U, V, Be, Li, Au, Pt.
Acid Radicals :Carbonate, Sulphite, Sulphide, Nitrite, Nitrate, Acetate, Flouride. Chloride, Bromide, Iodide, Sulphate, Borate, Oxalate, Phosphate, Silicate, Thiosulphate, Ferrocyanide, Ferricyanide, Sulphocyanide, Chromate, Arsenate and Permanganate.
2. Quantitative analysis: Involving separation of two of the following in ores, alloys, or mixtures in solution, one by volumetric and the other by gravimetric methods.
3. Estimation of :
a. Phosphoric acid in commercial orthophosphoric acid.
b. Boric acid in borax.
c. Ammonia in a ammonium salt.
d. Manganese dioxide in pyrolusite.
e. Available chlorine in bleaching powder.</td></tr>
</table>

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	f. Hydrogen peroxide in commercial samples. 4. Preprations: Preparation of selected inorganic compound and their studies by I.R. electronic spectra, Mössbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds a. $VO(acac)_2$ b. $TiO(C_9H_8NO)_2.2H_2O$ c. cis-K $[Cr(C_2O_4)_2(H_2O)_2]$ d. Na $[Cr(NH_3)_2(SCN)_4]$ e. $Mn(acac)_3$ f. $K_2[Fe(C_2O_4)_3]$ g. Prussian Blue, Turnbull's Blue. h. $[Co(NH_3)_6][Co(NO_2)_6]$ i. cis-$[Co(trien)(NO_2)_2]Cl.H_2O$ j. Hg $[Co(SCN)_4]$ k. $[Co(Py)_2Cl_2]$ l. $[Ni(NH_3)_6]Cl_2$ m. $Ni(dmg)_2$ n. $[Cu(NH_3)_4]SO_4.H_2O$ 5. Detection of elements (N, Cl, S) by Lassaigne's test 6. Detection of the following functional groups by systematic chemical analysis: Aromatic amino ($-NH_2$), aromatic nitro ($-NO_2$), Aimdo ($-CONH_2$, including imide), Phenolic –OH, Carboxylic acid (-COOH), Carbonyl (>C=O); only one test for each functional group is to be reported.
Course Outcome	On the completion of this course successfully student will be able to understand practical of inorganic chemistry and organic chemistry. .
Text Books	1. Vogel's Textbook of Quantitative Analysis, revi Mendham, ELBS. 2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly, Prentice Hall. 3. Practical Organic chemistry by A. I. Vogel. 4. Practical Organic chemistry by Mann and Saunders.

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	5. Practical Organic chemistry by Garg and Salija.
Reference Books	1. The Systematic Identification of Organic compounds, R. L. Shriner and D. Y. Curtin. 2. Semimicro Qualitative Organic Analysis, N.D. Cheronis, J. B. Entrikin and E. M. Hodnett. 3. Practical Physical chemistry by Alexander Findlay. 4. Experimental Physical chemistry, D. P. Shoemaker, G. W. Garland and J. W. Niber, McGraw Hill Interscience. 5. Findlay's Practical Physical chemistry, revised B

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<table>
<tr><td>Course Title</td><td colspan="5">CHEMISTRY LAB COURSE:II</td></tr>
<tr><td>Course Code</td><td colspan="5">MSCCH106P</td></tr>
<tr><td rowspan="2">Course Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>2</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Students must have the practical knowledge of handling spectroscopy and physical chemistry experiment.</td></tr>
<tr><td>Course Objective</td><td colspan="5">• To understand the practical concepts of spectroscopy and physical chemistry</td></tr>
<tr><td>Course Content</td><td colspan="5">1. Adsorption/Surface chemistry
a. To Study Surface Tension - Concentration relationship for solutions (Gibbs equation).
b. To Verify the Freundlich and Langmuir Adsorption isotherms using acetic acid/Oxalic acid and activated charcoal.
c. Determination of CMC of surfactants.
2. Phase Equilibria
a. To Construct the Phase diagram for three component system (e.g., chloroform-acetic acid-water).
3. Chemical Kinetics
a. Determination of the effect of (i) Change of temperature (ii) Change of concentration of reactants and catalyst and (iii) Ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.
b. Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micellar media.
c. Determination of the rate constant for the decomposition of hydrogen peroxide by Fe+++ and Cu++ ions.
d. Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidized by persulphate ion).</td></tr>
</table>

	4. Solutions/molecular weights a. Determination of molecular weight of non-volatile substances by Landsber b. Determination of molar masses ofNaphthelene/acetanilide c. Molecular weight of polymers by viscosity measurements. 5. Conductometry a. Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically. b. Determination of solubility and solubility product of sparingly soluble salts (e.g., PbSO4, BaSO4) conductometrically. c. Determination of pKa of Acetic acid and verification of Ostwald dilution law. 6. Potentiometry/pH metry a. Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter. b. Determination of the dissociation constant of acetic acid in DMSO, DMF, acetone and dioxane by titrating it with KOH. c. Determination of the dissociation constant of monobasic/dibasic acid by Albert-Serjeant method. d. Determination of Redox potential of Fe++/Fe+++ system. 7. Polarimetry a. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter. b. Enzyme kinetics –inversion of sucrose. c. Determine the specific and molecular rotation of optically active substances. 8. Error Analysis and Statistical Data Analysis a. Linear Regression Analysis b. Curve Fitting c. Student "t" Test d. Data Analysis Using Basic Statistical Parameters e. Calibration of volumetric Apparatus, Burette, Pipette Weight Box etc.

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	9. Use of Computer Programmes The students will learn how to operate a PC and how to run standard programmes and packages. Execution of linear regression, X-Y plot, numerical integration and differentiation as well as differential equation solution programmes. Monte Carlo and Molecular dynamics. Programmes with data preferably from physical chemistry laboratory. Further, the student will operate one or two or the packages such as Microsoft excel, word, power point, SPSS, Origin, Matlab and Easyplot.
Course Outcome	• On the completion of this course successfully student will be gain the practical knowledge for performing the experiments of spectroscopy and physical and analytical chemistry laboratory work.
Text Books	1. Experiments and Techniques in Organic Chemistry, D.Pasto, C. Johnson and M.Miller, Prentice Hall. 2. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Heath. 3. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold. Handbook of Organic Analysis –Qualitative and Quantitative, H. Clark, Adward Arnold. 4. Vogel's Textbook of Practical Organic Chemistry, 5. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman. 6. Findley's Practical Physical Chemistry, B.P. Levi
Reference Books	1. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill. 2. Computer and Common Sense, R. Hunt and J. Shelley, Prentice Hall. 3. Computational Chemistry, A.C. Norris. 4. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger. 5. Computer Programming in FORTRAN IV, V. Rajaraman, Prentice Hall. 6. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall.Experiments in Chemistry, D.V. Jahagirgar.

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<table>
<tr><td>Title</td><td colspan="5">Computer Fundamental and MS Office</td></tr>
<tr><td>Code</td><td colspan="5">MSCSE107</td></tr>
<tr><td rowspan="2">Credit</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>2</td><td>-</td><td>-</td><td>2</td><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">As per program</td></tr>
<tr><td>Course Learning Outcomes (CLO)</td><td colspan="5">After Completing this course, students will be able to:
• Study and use of basic concepts and terminology of information technology.
• Organize files and documents on storage devices.
• Acquire knowledge of ICT and Internet applications.
• Develop information technology solutions by evaluating user requirements in advance trends of IT
• Acquire knowledge of MS-Excel, MS-PowerPoint and MS-Access.</td></tr>
<tr><td>Credit Value</td><td colspan="2">3 Credits</td><td colspan="3">Credit = 15 Hours - Learning & Observation</td></tr>
<tr><td>Total Marks</td><td colspan="2">Max. Marks: 100</td><td colspan="3">Min Passing Marks: 40</td></tr>
<tr><td>Content</td><td colspan="5">UNIT-I
Introduction to Computer: History of computer, Generations and Classification, Basic Anatomy of Computer: Block Diagram, Central Processing Unit (CPU): Function of each Unit, Memory: Primary, Cache, Flash, Software and its needs, Types of S/W: System Software and Application Software, Types of Programming Language: Machine Language, Assembly Language, High Level Language their advantages and disadvantages, Language Processors/Translators: Assembler, Interpreter and Compiler, Fundamental of Information Technology: Data and Information, Concept of IT Application of IT, What is ICT?, Components of ICT, Impact of ICT in Society.

Advanced Trends in IT: Cloud Technology, Virtual LAN Technology, M-Commerce. Nanotechnology, Virtual Reality, 3-D Printing, Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), Cloud Computing, Quantum Computing, G Suite, GoI digital initiatives in higher education: SWAYAM, SwayamPrabha, National Academic Depository, National Digital Library of India, E-Sodh-Sindhu, Virtual labs, e-Yantra and NPTEL.
UNIT-II
MS-Word: Introduction to word processing software and its features, Creating new document, Saving documents, Opening and Printing documents. Home Tab:</td></tr>
</table>

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	Setting fonts, Paragraph settings, Various styles (Normal, No spacing, Heading1, Heading2, Title, Strong), Find & Replace, Format painter, Copy paste and paste special. Insert Tab: Pages, Tables, Pictures, Clipart, Shapes, Header & Footer, Word Art, Equation and Symbols. Page Layout Tab: Page setup, Page Background, Paragraph (indent and spacing). Mailing Tab: Create Envelops and Labels, Mail Merge. Review Tab: Spelling and Grammar check, New comment, Protect document, View Tab: Document views, Zoom, Window (New window, Split, Switch window). **UNIT-III** **MS-Excel:** Introducing Excel, Use of Excel sheet, creating new sheet, Saving, Opening, and Printing workbook. Home Tab: Font, Alignment, Number, Styles and cells and editing, Conditional Formatting. Insert Tab: Table, Charts (column chart, Pie chart, Bar chart, Line chart) and Texts (header & footer, word art, signature line). Page Layout Tab: Page setup options, Scale to fit (width, height, scale). Formulas Tab: Auto sum (sum, average, min, max), Logical (IF, and, or, not, true, false), Math & Trig (sin, cos, tan, ceiling, floor, fact, mod, log), Sort and Filter options, Data validation, Group and ungroup. Review Tab: Protect sheet, Protect workbook, and Share workbook. View Tab: Page breaks, Page layout, Freezing Panes, Split and hide. **UNIT-IV** **Working with PowerPoint and MS-Access** **PowerPoint:** Introducing PowerPoint, Use of PowerPoint presentation, Creating new slides saving. Opening and printing. Home Tab: New slide, Layout. Reset, Delete, Setting text direction, Align text, Convert to smart art, Drawing options. Insert Tab: Table, Picture, Clipart, Photo album, Smart art, Shapes and chart, Movie and sound, Hyperlink and action, Text box, Word art, Object. Design Tab: Page setup options, Slide orientation, Applying various themes, Selecting background style and formatting it. Animations Tab: Custom animation for entrance, Exit and emphasis, Applying slide transition, Setting transition speed and sound, Animation on rehearse timing. Slideshow & View Tab: Start slide, Show options, and Setup options. View tab: Presentation views, Colors and Window option. **MS-Access:** Introduction to DBMS, features of DBMS, creating blank databases, Saving it in accdb format, Defining data type in MS Access, Creating tables, creating reports, query wizard.
Keywords	**Information Technology (IT). Information and Communication Technology (ICT), G-Suite, MS Word, MS Excel, MS Power Point, MS-Access.**

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