THE LEARNING OUTCOME FRAME OF UG & PG COURSES

DEPARTMENT OF CHEMISTRY

PO, PSO AND CO OF UG CHEMISTRY

According to UGC guidelines. The chemistry graduates are expected to know the fundamental concepts of chemistry and applied chemistry. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.

- **Communication skills**: Chemistry graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience.

- **Critical thinking**: Chemistry graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.

- **Psychological skills:** Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various sociocultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.

- **Problem-solving:** Graduates are expected to be equipped with problem-solving philosophical approaches that are pertinent across the disciplines.

- **Analytical reasoning**: Graduates are expected to acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.

- **Research-skills:** Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other a priori reasoning including logical deduction.

- **Teamwork:** Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.

- **Digital Literacy:** Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.

- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.

- **Leadership readiness:** Graduates are expected to be familiar with decision-making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

Program outcome	To demonstrate a systematic, extensive and coherent knowledge and understanding of academic fields of study as a whole and its applications and links to disciplinary areas of the study; including critical understanding of the established theories, principles and concepts of a number of advanced and emerging issues in the field of chemistry;

BSc CHEMISTRY	
PO1:	To demonstrate procedural knowledge that creates different types of professionals in the field of chemistry. Further application of knowledge can enhance productivity of several economically important product. Knowledge of Chemistry is also necessary for the development and management of industry, manufacturing of fine chemicals.
PO2:	Developing skills and ability to use knowledge efficiently in areas related to specializations and current updates in the subject
PO3:	Demonstrate comprehensive knowledge about chemistry, current research, scholarly and professional literature of advanced learning areas of Chemistry.
PO4:	Communicate the results of studies in the academic field of Chemistry using main concepts, constructs and techniques
PO5:	Apply one's knowledge and understanding of Chemistry to new/unfamiliar contexts and to identify problems and solutions in daily life.

PO6:	To think any apply understanding of the subject of Chemistry, Chemical Sciences in identifying the problems which can be solved through the use of chemistry knowledge.
PO7:	To think of the adopting expertise in chemical sciences and solve the problems of environment, green chemistry, ecology, sustainable development, hunger, etc.

Program Specific outcome	program is designed to provide the students a comprehensive understanding about the fundamentals of chemistry with an objective to cover all the important principles and perspectives of physical, inorganic, organic and analytical chemistry expose the diversified aspects of chemistry where the students experience a broader outlook of the subject. have sound knowledge about the fundamentals and applications of chemical and scientific theories. every branch of science and technology is related to chemistry. easily assess the properties of all elements discovered. apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries. helps in understanding the causes of environmental pollution and can open up new methods for environmental pollution control. develops analytical skills and problem-solving skills requiring application of chemical principles. acquires the ability to synthesize, separate and characterize compounds using laboratory and instrumentation techniques so that

BSc CHEMISTRY	
PSO1 PHYSICAL CHEMISTRY:	In this program students will learn mathematical concept, significance of states of matter, i.e., gaseous, liquid and solid states, basics of thermodynamics, chemical kinetics, nuclear chemistry, colloidal sols, phase equilibrium, entropy, buffer solutions, phase rule,

	electrochemistry, photochemistry, UV-VIS, IR, Raman, NMR spectroscopies.
PSO2 INORGANIC CHEMISTRY:	Atomic structure Schrodinger wave, de Broglie's Equation, Ionic, covalent, coordinate bonds, periodic table covering s, p, d, and f block elements, periodic properties. Chemical properties, theories of coordination compounds like Werner, VBT, CFT & MOT. Bioinorganic chemistry nitrogen fixation, concept of hard & soft acids and bases gravimetric analysis. Inorganic polymers, Errors, Magnetic & spectral properties of complexes, Orgel energy level diagrams.
PSO3 ORGANIC CHEMISTRY:	Reaction mechanism electrophilic, nucleophilic substitutions and additions, methods of preparations, important physical and chemical properties, saturated &unsaturated hydrocarbons, structure and substitution reactions of benzene, alcohols, phenols, aldehydes, ketones, carboxylic acids, acid derivatives like acid chlorides, amides, anhydrides, ammines. Electromagnetic & IR spectroscopy, organic compounds of nitrogen, Carbohydrates nucleic acids i.e., DNA & RNA, fats, oils, and detergents, Organometallic compounds
PSO4: LABORATORY COURSE: CHEMISTRY PRACTICAL	Determination of melting point, boiling point, Weighing and preparation of solution, surface tension, viscosity, Crystallization, Sublimation, Verification of Beer's-Lambert law. Job's method etc.
	Detection of elements, Identification of functional group, organic compound, separation of organic compounds, preparation
	Inorganic mixture analysis, interfering radical, Separation of cations by paper and thin chromatography, volumetric & gravimetric analysis preparation of complexes

B. Sc. First Year

Course outcome — *On completion of this course, successfully students will be able to learn:*

Title of the paper

FIRST PAPER -PHYSICAL CHEMISTRY	
CO1:	Simple mathematics, derivation of some chemical equations like order of reaction.
CO2:	Properties of gases and velocity of gas molecules. Solids, Geometry of crystals, liquid crystals, important applications.
CO3:	Chemical Kinetics scope, determination of rate of reaction, factors affecting.
CO4:	Understanding phenomena of Radioactivity, theory of nuclear fission and fusion, half-life period and its applications.
CO5:	Chemical equilibrium, Law of mass action, Colloidal Sols their classification, important properties like kinetic, optical, and electrical, coagulation, Hardy Schultz rule, gold number.
SECOND PAPER -INORGANIC CHEMISTRY	
CO1:	Atomic orbitals, shape of orbitals and rules for filling of electron in orbitals. Screening effect.
CO2:	Periodic properties, factors affecting them, and methods of their evaluation.
CO3:	Valence Bond Theory, VSEPR theory, Molecular Orbital theory. Born-Haber cycle, Covalent nature in ionic bond by Fazan's rule, Metallic bond.
CO4:	Chemistry of noble gases and its compounds.
CO5:	‘s’ and ‘p’ block elements, function of s block elements in bio-system and binary compounds Diborane, higher boranes, borazines, fullerenes and interhalogen compounds, poly-halides.
THIRD PAPER -ORGANIC CHEMISTRY	
CO1:	Hybridization, bond length, bond angles, bond energy, Resonance hyperconjugation, inductive, electrometric, mesomere, and steric effects.
CO2:	Homo- and heterolytic bond fission, electrophiles & nucleophiles,

CO3:	Hydrocarbon's preparation, properties & uses. Important reactions- Wurtz, Kolbe, Diels- Alder. Chloroform, carbon tetrachloride preparation, properties electrophilic and nucleophilic substitutions (SN1 &SN2).
CO4:	Stereochemistry- optical isomerism properties, Di stereoisomers, resolution of enantiomers, inversion, retention, and racemization.
CO5:	Relative and absolute configuration, sequence rule, D&L and R&S systems of nomenclature. Geometrical Isomerism, determination of configuration of geometrical isomers, E & Z system of nomenclature.

LABORATORY COURSE: CHEMISTRY PRACTICAL

CO1:	✓ Determination of melting point ✓ Determination of boiling point ✓ Weighing and preparation of solution
CO2:	✓ Determination of surface tension/percentage composition or given liquid mixture using surface tension method. ✓ Determination of viscosity/ percentage composition of given liquid mixture using viscosity method.
CO3:	✓ Inorganic mixture analysis Mixture analysis for 2 cation and 2 anions ✓ Separation of cations by paper chromatography
CO4:	✓ Crystallization ✓ Sublimation ✓ Detection of elements
CO5:	✓ Identification of functional group

B. Sc. Second Year

Course outcome — *On completion of this course, successfully students will be able to learn:*

Title of the paper

FIRST PAPER -PHYSICAL CHEMISTRY	
CO1:	Thermodynamic terms, second and third law of thermodynamics, Carnot cycle, entropy, Nernst heat theorem, Gibbs(G) & Helmholtz (A) functions Thermochemistry; enthalpy, Hess's law of constant heat summation, heat of reaction, buffer action, Henderson-Hazel equation.
CO2:	Phase rule and electrochemistry, solid solutions, liquid-liquid mixtures, Raoult's, Henry's, and Nernst law with their applications.
CO3:	Basics of electrochemistry
CO4:	Types of electrodes, electrolytic and galvanic cells.
CO5:	Surface Chemistry, Adsorption, Catalysis
SECOND PAPER -INORGANIC CHEMISTRY	
CO1:	Chemistry of first transition series elements.
CO2:	Chemistry of second and third transition series elements.
CO3:	Coordination compounds, Oxidation and Reduction
CO4:	Chemistry of lanthanides and actinides
CO5:	Acids and Bases, Non aqueous solvents
THIRD PAPER -ORGANIC CHEMISTRY	
CO1:	Electromagnetic spectrum: UV and IR spectroscopy
CO2:	Nomenclature and chemistry associated with monohydric, dihydric and trihydric alcohols oxidative cleavage, pinacol-pinacolone rearrangement. Nomenclature, preparation methods, reaction mechanisms for acetylation, carboxylation, Fries rearrangement, Gattermann synthesis, Hauben-Hoesch, Lederer-Manasse and Reimer-Tiemann reactions Phenols: Nomenclature and chemistry, structure and bonding
CO3:	Preparation, properties of aldehydes and ketones. Knoevanagel, Gattermann -

	Koch, Cannizaro, Rosenmund, Perkin, Wittig, Reformatsky, Mannich, and Diels-Alder
CO4:	Chemistry of Carboxylic acids, preparation of Lactic, tartaric, citric acids and their important chemical properties. Ethers: nomenclature, preparation and properties
CO5:	Organic compounds of nitrogen: nitro alkanes, nitro arenes, halo nitro arenes

LABORATORY COURSE: CHEMISTRY PRACTICAL

CO1:	✓ Analysis of inorganic mixture containing five radicals with at least on interfering radical. ✓ Determination of acetic acid in commercial vinegar using NaOH. ✓ Redox titrations. ✓ Estimation of hardness of water by EDTA.
CO2:	✓ Determination of transition temperature of given substance by thermometric method. ✓ To determine the enthalpy of neutralization of strong acid, strong base. ✓ Verification of Beer's-Lambert law. ✓ To study the phase diagram of two component system by cooling curve method.
CO3:	(i) Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives. (ii) Use of Paper chromatography/Thin layer chromatography: determination of R_f values, separation and identification of organic compounds. a. Separation of green leaf pigments (spinach leave may be used) b. Separation of dyes

B. Sc.Third Year

Course outcome — *On completion of this course, successfully students will be able to learn:*

Title of the paper

FIRST PAPER -PHYSICAL CHEMISTRY	
CO1:	Elementary Quantum Mechanics, postulates of quantum mechanics, particle in a one-dimensional box. Molecular orbital theory, Introduction to valence bond model of H_2 ion, comparison of M.O. and V.B. models.
CO2:	Spectroscopy-Introduction, Rotational Spectrum, Vibrational Spectrum
CO3:	Raman Spectrum, Electronic Spectrum, UV Spectroscopy
CO4:	Photochemistry
CO5:	Physical Properties and Molecular Structure
SECOND PAPER -INORGANIC CHEMISTRY	
CO1:	Hard and Soft Acids and Bases (HSAB), Silicones and Phosphagens
CO2:	Metal Ligand Bonding in Transition Metal Complexes, Thermodynamic and Kinetic Aspects of Metal Complexes.
CO3:	Magnetic Properties of Transition Metal Complexes,
CO4:	Electronic Spectra of Transition Metal Complex, Organometallic Chemistry
CO5:	Bio-Inorganic Chemistry, Metal Nitrosyl Complex
THIRD PAPER -ORGANIC CHEMISTRY	
CO1:	Spectroscopy: Nuclear Magnetic Resonance Spectroscopy.
CO2:	Organo-Metallic compounds: Organo-magnesium compounds, Organo-Sulphur compounds, Organic synthesis by enolates:
CO3:	Carbohydrates, Fat, Oil and Detergents
CO4:	Amino Acid, Peptide, Protein and nucleic acid, Synthetic dyes

CO5:	Introduction of pyrrole, furan, thiophene and pyridine, Introductory idea about five-and six-membered condensed heterocyclic compounds

LABORATORY COURSE: CHEMISTRY PRACTICAL

CO1:	✓ Gravimetric analysis: o Barium as Barium sulphate, Copper as cuprous-thiocyanate. ✓ Complex compound preparation ✓ Potassium chlorochromate (IV) ✓ Tetramine copper (II) sulphate monohydrate ✓ Hexa ammine nickel (II) chloride ✓ Effluent water analysis, Identification of cations and anions in different samples. ✓ Water analysis, to determine dissolved oxygen in water samples in ppm.
CO2:	✓ To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature. ✓ Determination of partition coefficient of iodine between carbon tetra chloride and water. ✓ Job's method. ✓ pH-metric titrations, conductometric titrations.
CO3:	✓ binary mixture analysis containing two solids: separation, identification and preparation of derivatives ✓ preparation ✓ acetylation, (ii) Benzoylation, (iii) Meta dinitro benzene (iv) Picric acid

Program outcome

Program is designed to provide the students a comprehensive understanding about the awareness and sense of responsibilities towards environment, apply knowledge to build up small scale industry for developing endogenous product, various aspects of chemistry in natural products isolations, pharmaceuticals, dyes, textiles, polymers, petroleum products, forensic etc. And also, to develop interdisciplinary approach of the subject. so that students will be able to use this knowledge in advancement of their career.

MSc CHEMISTRY	
PO1:	Demonstrate and apply the fundamental knowledge of the basic principles in various fields of Chemistry
PO2:	It would help students to collaborate effectively on team-oriented projects in the field of Chemistry or other related fields.
PO3:	It would help students to communicate scientific information in a clear and concise manner both orally and in Writing.
PO4:	It would help students to inculcate logical thinking to address a problem and become result oriented with a positive attitude
PO5:	It would help students to Have developed their critical reasoning, judgment and communication skills.
PO6:	Augment the recent developments in the field of green and eco-friendly reactions, pharmaceutical, supramolecular, Bioinorganic Chemistry and relevant fields of research and development
PO7:	It would help students to apply the knowledge to develop the sustainable and eco-friendly technology in Industrial Chemistry.
PO8:	It would help students to 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.

M. Sc. Chemistry: Program Outcome

Program Specific Outcome

Program Specific outcome	program is designed to provide the students a comprehensive understanding about the fundamentals of chemistry with an objective to cover all the important principles and perspectives of physical, inorganic, organic and analytical chemistry expose the diversified aspects of chemistry where the students experience a broader outlook of the subject. have sound knowledge about the fundamentals and applications of chemical and scientific theories. so that students will be able to use this

MSc CHEMISTRY	
PSO1:	Chemical bonding theories i.e. Valence Bond Theory, Crystal Field Theory, and Molecular Orbital Theory, mechanism of nucleophilic substitution SN1 &SN2 for octahedral and square planar geometries. spectroscopic techniques like IR, Raman, NMR, ESR, Mass, Mossbauer spectroscopy and their applications. Correlation between vibrational spectroscopy and group theory. Bioinorganic chemistry structure and functioning of metalloenzymes and metalloproteins. Students will learn structure and bonding of metal carbonyls, metal nitrosyls and chemistry of Boranes, their nomenclature. Structure and bonding of dioxygen complexes
PSO2:	Aromaticity, antiaromaticity, homoaromatic, stereochemistry, conformational analysis in mechanisms involved, nucleophilic and electrophilic substitution and elimination type of reactions, basic principles, instrumentation and applications of spectroscopic techniques i.e., IR, Raman, NMR, ESR, UV-VIS and Mass for characterization, Photochemical reactions, Pericyclic Reactions, Elimination reactions,

	chemistry involved in functioning of enzymes
PSO3:	Basic principle and applications of Quantum Mechanics. Schrödinger Wave Equation, Approximation methods, angular moments, laws of thermodynamics, classical dynamics and applications. Adsorption phenomenon, capillary action, equations like Laplace and Kelvin and electrokinetic phenomenon. Electrochemistry, Debye-Huckle-Onsager treatment and Lipmann electro capillary phenomenon, solid state chemistry application, crystal defects, homo& heterogeneous catalysis, metallic bonds, conductors, semiconductors, NMR&ESR spectra Theory of photochemistry and phenomena like phosphorescence, fluorescence and their applications
PSO4:	Microwave, infrared, Raman and electronic spectroscopy. Basics of pure mathematics algebra, differential & integral calculus, probability, permutation, topics of biology i.e., structure and functions of cell, chemistry of lipids, fats, amino acids. Analytical Chemistry, statistical analysis, types and minimization of errors, accuracy and precision. Separative techniques like chromatography, Photoelectron spectroscopy, X-Ray, Electron &Neutron Diffraction. Biopolymers, thermodynamics and transport of biopolymeric ions.
PSO6: **LABORATORY COURSE: CHEMISTRY PRACTICAL**	Use modern techniques, handling equipment's, qualitative and quantitative analytical skills. Acquires the ability to synthesize, separate and characterize compounds using laboratory and instrumentation techniques. Carry out experiments in the area of organic analysis, estimation, separation, derivative process, inorganic semi micro analysis, preparation, conductometric, spectrophotometry, chemical kinetics, electronics, molecular modelling, Polarimetry, pH meter and potentiometric analysis etc.

Course Outcome

This program is designed with an objective to cover all important topics of physical, inorganic, organic and analytical branches so that students will be able to use this knowledge in advancement of their career.

M. Sc. First Semester

Course outcome *On completion of this course, successfully students will be able to learn:*

Title of the paper

FIRST PAPER (MCH 101) INORGANIC CHEMISTRY	
CO1:	Stereochemistry, bonding, VSEPR theory, MO treatment
CO2:	Reaction mechanism of Substitution inertness and lability
CO3:	Electronic spectra of transition metal complexes
CO4:	Metal carbonyls, Dioxygen Complexes
CO5:	Wilkinson's Catalyst, borane chemistry including topology, nomenclature, reactivity and bonding.
SECOND PAPER (MCH102) ORGANIC CHEMISTRY	
CO1:	Structure and bonding in organic molecules
CO2:	Aromaticity, antiaromaticity, homo aromaticity including weaker bonds.
CO3:	Stereochemistry, symmetry, chirality, optical activity and conformational analysis,
CO4:	Reaction mechanism, Hammett equation, SN1, SN2 and SET mechanism,
CO5:	UV-VIS, ORD &CD Spectroscopy.
THIRD PAPER (MCH 103) PHYSICAL CHEMISTRY	
CO1:	Schrodinger Wave equation, variation and perturbation theory,
CO2:	Classical thermodynamics,
CO3:	Phase rule, chemical dynamics, Arrhenius Equation,
CO4:	Theory of reaction rate and application of rate law on dynamic chain reaction

CO5:	Reaction catalysts.
FOURTH PAPER (MCH104) SPECTROSCOPY	
CO1:	Electromagnetic spectrum
CO2:	Microwave spectroscopy
CO3:	Infrared Spectroscopy
CO4:	Raman and Electronic spectroscopy.
CO5:	CARS (Coherent and Stokes Raman Spectroscopy) and application of these spectral techniques in structure determination of molecule.
FIFTH PAPER (MCH 105 A) MATHEMATICS FOR CHEMIST	
CO1:	Basic concept of mathematical technique involved in Chemistry like Mathematics Algebra
CO2:	Differential calculus, integral calculus,
CO3:	Elementary differential equation
CO4:	Permutation
CO5:	Probability.
FIFTH PAPER (MCH 105 B) BIOLOGY FOR CHEMIST	
CO1:	Cell structure
CO2:	Cell organs, and their function
CO3:	Carbohydrates,
CO4:	Lipids and fats, amino acids
CO5:	Nucleic acids.
LABORATORY COURSE: CHEMISTRY PRACTICAL	
COURSE MCH 106: INORGANIC CHEMISTRY	
CO1:	Qualitative and Quantitative Analysis
CO2:	Chromatography
CO3:	Preparations- Preparation of selected inorganic complexes and their studies by measurements of decomposition temperature, molar conductance, IR and electronic spectra.

COURSE MCH 107: ORGANIC CHEMISTRY	
CO1:	Qualitative Analysis: Separation, purification and identification of compounds of binary mixture. Emphasis should be placed on physical principles, reaction chemistry and the technique involved in analysis.
CO2:	Organic Synthesis-Purification of compounds by TLC and column chromatography.
CO3:	Aromatic electrophilic substitutions, Reduction reaction
CO4:	Quantitative Analysis-*Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method*
COURSE MCH 108: PHYSICAL CHEMISTRY	
CO1:	Adsorption
CO2:	Phase Equilibria
CO3:	Chemical Kinetics
CO4:	Solutions

M. Sc. Second Semester

Course outcome	*On completion of this course, successfully students will be able to:* ***Title of the paper***
FIRST PAPER (MCH 201) INORGANIC CHEMISTRY	
CO1:	Metal ligand equilibrium, reaction mechanism, base hydrolysis, conjugate base mechanism in octahedral and mechanism of square planar complexes.
CO2:	Metal-ligand bonding
CO3:	Calculations of Dq, B and beta parameters
CO4:	Preparation, properties, structure and applications of metal nitrosyls.
CO5:	Symmetry elements, symmetry operations and the principle involved in group theory.
SECOND PAPER (MCH 202) ORGANIC CHEMISTRY	
CO1:	Mechanism- aromatic/aliphatic electrophilic substitution
CO2:	Free radical, allylic halogenation reaction,
CO3:	Addition to carbon-carbon and carbon-hetero atom multiple bond and aromatic

	nucleophilic substitution, SE1, SE2, SN1 SN2 & SRN1 reactions.
CO4:	ESR Spectroscopy
CO5:	IR and Raman spectra and their application in characterization of organic compounds.
THIRD PAPER (MCH 203) PHYSICAL CHEMISTRY	
CO1:	Chemical dynamics
CO2:	Adsorption and electrokinetic phenomenon,
CO3:	Micellization, DHO equation.
CO4:	Lipmann electro-capillary phenomenon including different models.
CO5:	Macromolecules and colloid including their types, emulsification, irreversible electrode phenomenon including decomposition voltage overlaps.
FOURTH PAPER (MCH 204) SPECTROSCOPY & DIFFRACTION METHODS	
CO1:	Photoelectron spectroscopy, photoacoustic spectroscopy,
CO2:	X ray Diffraction, Neutron Diffraction.
CO3:	Biological cell, constituents,
CO4:	Bioenergetics
CO5:	Thermodynamics of biopolymer solution and transport of ion through the cell membrane.
FIFTH PAPER (MCH 205) COMPUTER FOR CHEMIST	
CO1:	Basic knowledge of computer and computing
CO2:.	BASIC and FORTRAN based programming with especial reference to programming in chemistry.
CO3:	Rerunning of standard program in MS Word and MS Excel
CO4:	Search engines and various types of files like PDF, RTF, JPG
CO5:	OMR & Webcam.
LABORATORY COURSE: CHEMISTRY PRACTICAL	
COURSE MCH 206: INORGANIC CHEMISTRY	
CO1:	Chromatography Separation of cations and anions by Column Chromatography

CO2:	Estimation of Ni – Fe, Ni (Gravimetrically), Fe (Volumetrically)
CO3:	Preparations- Preparation of selected inorganic complexes and their studies by measurements of decomposition temperature, molar conductance, IR and electronic spectra.
CO4:	Interpretation of TG and NMR spectra of some known compounds
COURSE MCH 207: ORGANIC CHEMISTRY	
CO1:	Qualitative Analysis: Separation, purification and identification of compounds of binary mixture. Emphasis should be placed on physical principles, reaction chemistry and the technique involved in analysis.
CO2:	Preparation of phenyl azo – β – naphthol from aniline.
CO3:	Aromatic electrophilic substitutions, Reduction reaction
CO4:	Quantitative Analysis-*Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method*
COURSE MCH 208: PHYSICAL CHEMISTRY	
CO1:	***Electrochemistry***
CO2:	***Conductometry***
CO3:	***Potentiometry/pH merry***
CO4:	***Polarimetry***

M. Sc. Third Semester

Course outcome	*On completion of this course, successfully students will be able to:* ***Title of the paper***
FIRST PAPER (MCH 301) INORGANIC CHEMISTRY	
CO1:	Group theory, Character tables, orthogonality theorem, applications for C2v and C3v point groups
CO2:	Correlation of vibrational spectroscopy with group theory. They will also understand molecular energy levels and M.O. Diagrams, bonding of multidentate ligands, characterization by IR &Raman spectroscopy.

CO3:	Shift reagents in NMR spectroscopy
CO4:	Structure and functioning of metalloenzymes e.g., carboxypeptidase, carbonic anhydrase
CO5:	Structure and functioning of biomolecules like Hemoglobin.
SECOND PAPER (MCH 302) ORGANIC CHEMISTRY	
CO1:	Basic theory of NMR spectroscopy, applications to characterize organic compounds.
CO2:	Photochemical reactions.
CO3:	Mechanism of pericyclic reaction,
CO4:	Woodword Haffmann, FMO &PMO approach
CO5:	Sigma tropic rearrangements.
THIRD PAPER (MCH 303) PHYSICAL CHEMISTRY	
CO1:	Atomic concepts, Russell-Saunders terms and coupling. Molecular Orbitals, Huckel theory of conjugated systems like ethylene, butadiene
CO2:	Homo and heterogeneous catalysis.
CO3:	Crystal defects. Schottky and Frankel defects
CO4:	Solid state reactions. Metallic bond
CO5:	Conductors, semiconductors, insulators and superconductors
FOURTH PAPER (MCH 304 B) ANALYTICAL CHEMISTRY	
CO1:	Statistical Analysis., Sample Preparation for Chromatography.
CO2:	Chromatography. Theory of Chromatography, Gas Chromatography, High-Performance Liquid Chromatography, Capillary Electrophoresis.
CO3:	Ion Exchange, Solvent Extraction
CO4:	Atomic Absorption Spectrometry, Electrolytic Methods
CO5:	Acid-Base Titrations, Precipitation Titrations, Complexometric Titrations, Redox Titrations.
FIFTH PAPER (MCH 304C) ELECTIVE PAPER: PHOTOCHEMISTRY	

CO1:	Photochemical Reactions
CO2:.	Determination of Reaction Mechanism
CO3:	Photochemistry of Alkene
CO4:	Photochemistry of Carbonyl
CO5:	Miscellaneous Photochemical Reactions, Photo degradation of polymers. Photochemistry of vision.

LABORATORY COURSE: CHEMISTRY PRACTICAL

COURSE MCH 306: INORGANIC CHEMISTRY

CO1:	**Synthesis** Synthesis of selected inorganic compounds and their studies by measurements of decomposition temperatures and molar conductance, magnetic and IR electronic spectra.
CO2:	Qualitative test of suitable anion and determination of metal content gravimetrically in the above compounds.
CO3:	Interpretation of ESR and mass spectra of some known coordination compounds.

COURSE MCH 307: ORGANIC CHEMISTRY

CO1:	**Qualitative Analysis** Separation, purification and systematic identification of the components of a mixture of three organic compounds (solids and liquids). Preparation of one derivative of each compound. Use of TLC for ascertainment of purity of compounds.
CO2:	**Multi-step Synthesis** This exercise should illustrate the use of organic reactions/ diverse conditions and principles for organic synthesis. Purification of compounds by chromatographic techniques.

COURSE MCH 308: PHYSICAL CHEMISTRY

CO1:	Potentiometry
CO2:	Conductivity

CO3:	Spectrophotometry
CO4:	Molecular Modeling

M.Sc. Fourth Semester

Course outcome *On completion of this course, successfully students will be able to:*

Title of the paper

FIRST PAPER (MCH 401) INORGANIC CHEMISTRY	
CO1:	ESR Spectroscopy
CO2:	Mossbauer, IR, Raman spectroscopy,
CO3:	Point groups and vibrational spectroscopy.
CO4:	Bio-inorganic chemistry, chlorophyll, photo systems one and two,
CO5:	Metalloproteins cytochromes, iron Sulphur protein, Nitrogen fixation.
SECOND PAPER (MCH 402) ORGANIC CHEMISTRY	
CO1:	^{13}C NMR Spectroscopy
CO2:	Mass spectroscopy.
CO3:	Reaction mechanism of elimination, E1, E2 & E1CB type,
CO4:	Substitution reactions.
CO5:	Enzymes, structure and functioning.
THIRD PAPER (MCH 403) PHYSICAL CHEMISTRY	
CO1:	NMR, ESR spectroscopy.
CO2:	Laws of photochemistry, fluorescence,
CO3:	Steric and conformational properties of molecules,
CO4:	Winstein-Holmer and Curtin-Hammett Equations
CO5:	CO5: Electronic effects involved in SN1 and SN2 type of reactions, and curve crossing model.
FOURTH PAPER (MCH404) POLYMER CHEMISTRY	
CO1:	Basic theory, classification of polymers
CO2:	Characterization, important properties of polymers

CO3:	Commercial importance of polymers
CO4:	Processing to understand different types of casting like die-rotational, film
CO5:	Methods for designing variety of polymers
FIFTH PAPER (MCH 405A) ELECTIVE: CHEMISTRY OF NATURAL PRODUCTS	
CO1:	*Terpenoids*
CO2:	*Alkaloids*
CO3:	*Steroids*
CO4:	*Plant Pigments. Carotenoid, Flavonoids, Chlorophyll*
CO5:	*Vitamins and Antibiotics, Antibiotics.*
LABORATORY COURSE: CHEMISTRY PRACTICAL	
COURSE MCH 406: INORGANIC CHEMISTRY	
CO1:	Spectrophotometric Determination
CO2:	Flame photometric determination
CO3:	Model Experiments on Cyclic Voltammetry
CO4:	Interpretation of ESR, NMR and Thermogravimetric pre-recorded results of known compounds
COURSE MCH 407: ORGANIC CHEMISTRY	
CO1:	Multi-step Synthèses - Qualitative & Quantitative
CO2:	Quantitative Analysis
CO3:	Spectral Analysis: Interpretation of pre-recorded UV-Vis, IR, NMR, Mass, Raman spectrum and characterization of one organic compound.
COURSE MCH 408: PHYSICAL CHEMISTRY	
CO1:	Spectrophotometry
CO2:	Chemical Kinetics
CO3:	Electronics
CO4:	Molecular Modeling