Dr. Hari Singh Gour Vishwavidyalaya, Sagar
M.Sc. CHEMISTRY
2023 – 24 (NEP)
SCHEME OF EXAMINATION SEMESTER IV

	Course Code	Course Name	Credits
		Discipline Specific	
1	CHE-DSM-421	Photochemistry and Solid State Chemistry	4
2	CHE-DSM-422	Bioinorganic, Bioorganic and Bio Physical Chemistry	4
		Laboratory Courses	
3	CHE-DSM-423A	**A:** Dissertation in Chemistry; **OR**	6
	CHE-DSM-423B	**B:** Laboratory Exercises based on Curricula DSM, MDM & SEC (Applied -Inorganic, Organic, Physical, Analytical, Biochemistry, Material Science, & Instrumentation)	6
		Multidisciplinary	
4	CHE-MDM-421	Organic Synthesis, Drug design & Medicinal Chemistry	4
		Skill enhancement course	
5	CHE-SEC-EC-421A	Analytical Chemistry	3
6	CHE-SEC-EC-421B	Photo-inorganic, Radioactivity & Radiation Chemistry	3
7	CHE-SEC-422	Instrumentation, Analysis and Interpretation	1
		Total Credits:	**22**

Distribution of Marks :

Mid Sem. Exam 20 marks	Internal Assessment 20 marks	Total 40 Marks	End Sem Marks	Total Marks
20	**20**	**40**	**60**	**100**

Department of Chemistry
Dr. Harisingh Gour Vishwavidyalaya, Sagar
Scheme of M.Sc. Program in Chemistry under NEP

Objectives and Learning Outcomes of M.Sc. Chemistry

Department of Chemistry						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	Chemistry	Fourth	CHE-DSM-421	Photochemistry and Solid State Chemistry	Mid Sem: 40 End Sem = 60	04

Course Objectives: Advance knowledge of spectroscopy with electronic properties and band theory.

Course Learning Outcomes: Upon successful learning, students will be able to learn
Unit-I: Interaction of electromagnetic radiation with small molecules.
Unit-II: Photochemical reactions of different types of carbonyl compounds.
Unit-III: Application of band theory and crystal defects.
Unit-IV: Optical, magnetic and electric properties of materials
Unit-V: Chemistry of superconductors.

Suggested readings:

- Fundamentals of Photochemistry, K.K. Rahatagi-Mukherjee, Wiley-Eastern.
- Essentials of molecular photochemistry, A. Gilbert, and J. Baggott
- Introductory photochemistry, A. Cox and T. Camp, McGraw-Hill
- Solid State Chemistry and its applications, A.R. West, Plenum
- Principles of Solid state. H. V. Keer, Wiley Eastern
- Solid state Chemistry, N. B. Hannay
- Solid State Chemistry, D. K. Chakrabarty, New Age International

M.Sc. Chemistry, Semester I

CHE-DSM-421

Photochemistry and Solid State Chemistry

Credits :4		60 Hrs
UNIT I	**Photochemical Reactions:** Types of excitations, fate of excited molecules, quantum yield, transfer of excitation energy. Determination of Reaction Mechanism , Classification, rate constant and life times of reactive energy states — determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Photo-dissociation, gas - phase photolysis.	12
	Photochemistry of Alkenes : Intramolecular reactions of the olefinic bond — geometrical isomerism, cyclisation reactions, rearrangement of 1,4 and 1,5- dienes	12
UNIT II	**Photochemistry of Carbonyl Compounds:** Intramolecular reactions of carbonyl compounds – saturated, cyclic and acyclic, unsaturated and - unsaturated compounds. Cyclohexadienones. Intermolecular cycloaddition reactions- dimerisation and oxetane formation **Photochemistry of Aromatic compounds :** Isomerisations, additions and substitutions. **Miscellaneous Photochemical Reactions:** Photo- Fries reactions of anillides. Photo-Fries rearrangement, Barion reaction, Single molecular oxygen reactions, Photo-chemical formation of Smog, Photo-degradation of polymers. Photochemistry of vision, Chemistry of Sensitizers	12
UNIT III	**Solid state reactions** : General principles, experimental procedures, co-precipitation as a precursor to solid state reactions, kinetics of solid state reactions **Crystal Defects and Non stoichiometry** Perfect and imperfect crystals, intrinsic and extrinsic defects- point defects, line and plane defects, vacancies; Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stochiometry and defects. **Band theory**, band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions,	12
UNIT IV	**Optical properties** – Optical reflectance, photo-conduction, Phosphors in fluorescent lights, Light-Emitting Diodes; Quantum Wells-blue lasers; Optical Fibres; Photonic Crystals; Metamaterials- Cloaks of Invisibility. **Magnetic and Electrical Properties** Magnetic Properties – Classification of materials: Quantum theory of Paramagnetics - cooperative phenomena-magnetic domains, hysteresius: Paramagnetism in metal complexes, Ferromagnetic compound- Chromium dioxide; Antiferromagnetism – ferrites, magnetic strips on Swipe Cards; Spiral Magnetism; Giant, Tunnelling and Colossal Magnetoresistance; effect of temperature on magnetic materials,; Electrical Polarisation; Piezoelectric Crystals; Ferroelectric effect; Multiferroics (Type –I & II)	12
UNIT V	**Superconductivity:** Conventional Superconductors; Magnetic properties, BCS Theory; High temperature superconductors, Cuprates- & Iron superconductors; Theory of High Tc superconductors; Uses of high temperature Superconductors	

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Objectives and Learning Outcomes of M.Sc. Chemistry

Department of Chemistry						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	Chemistry	Fourth	CHE-DSM-422	Bioinorganic, Bioorganic and Bio Physical Chemistry	Mid Sem: 40 End Sem = 60	04

Course Objectives: Advance knowledge of spectroscopy with electronic properties and band theory.

Course Learning Outcomes: Upon successful learning, students will be able to learn

Unit-I: Metallobiomolecules, understanding on Hb,Mb, Cytochrome, models etc.

Unit-II: Bioorganic molecules, biosynthesis, catalyzing action , ATP etc.

Unit-III: Enzymes, models- understanding & Biotechnology; recombinant technology.

Unit-IV: Understanding of Biophysical aspects of Biothermodynamics, biopolymers, membrane transport .

Unit-V: Biopolymers- Physicochemical evaluation & biopolymer measurements & analysis.

Suggested readings:

- Principle of Bioinorgainc Chemistry, S. J. Lippard and J.M. Berg.
- Bioinorganic Chemistry by I. Bertini, H.B. Grey, S.J. Lippard and J.S. Valentine, University Science Book.
- Bioorganic Chemistry, A chemical approach to enzyme action, Hermann Dugas and C. Penny, Springer-Verlag
- Understanding enzymes, Trevor Palmer, Prentice Hall.
- Principles of Biochemistry, A. L. Lehninger, Worth Publishers
- Biochemistry, L. Stryer, W. H. Freeman.

M.Sc. Chemistry semester IV CHE-DSM-422 Bioinorganic, Bioorganic and Biophysical Chemistry		
Credits : 4		60 Hrs
UNIT I	**Bioinorganic Chemistry** Transport and Storage of Dioxygen:-Heme proteins and oxygen uptake, structure and function of Haemoglobin, Myoglobin, Hemocyanins and Hemerythrin, model synthetic complexes of Iron, cobalt and copper. Electron Transfer in Biology:- Structure and function of metalloproteins in electron transport process – cytochromes and Iron – sulphur proteins, synthetic models.	12
UNIT II	**Bio-organic Chemistry:** Kinds of Reactions Catalysed by Enzymes: Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes, Transfer of sulphate, addition and elimination reactions, enolic intermediates in isomerization reactios, β - cleavage and condensation, some isomerization and rearrangement reactions, Enzyme catalyzed carboxylation and decarboxylation.	12
UNIT III	**Enzyme Models**: Host – guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biomimetic chemistry, crown ether, cryptates.Cyclodextrins, cyclodextrin- based enzyme models, calixarenes, ionophores, micelles, synthetic enzymes or synzymes **Bio-technological applications of enzymes :** Large scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry- brewing and cheese making, syrups from corn starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.	12
UNIT IV	**Biophysical Chemistry:** Thermodynamics of Biopolymer Solutions ; osmotics pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system. **Cell Membrane and Transport of Ions** : ion transport through cell membrane, irreversible thermodynamics treatment of membrane transport, Nerve conduction.	12
UNIT V	**Biopolymers** and their Molecular Weights : Evaluation of size, shape molecular weight and extent of hydration of biopolymers by various experimental techniques, Sedimentation equilibrium, hydrodynamic methods, diffusion, sedimentation velocity, viscosity, electrophoresis and rotational motions. **Diffraction Methods in polymer analysis** : Light scattering, low angle X-Ray scattering, X-Ray diffraction.	12

Department of Chemistry
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Scheme of M.Sc. Program in Chemistry under CBCS system
Objectives and Learning Outcomes of M.Sc. Chemistry Course

Department of Chemistry						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	Chemistry	Fourth	CHE-DSM-423A	Dissertation in Chemistry	Mid Sem: 40 End Sem = 60	06

Course Objectives: Advance and Applied knowledge of Chemical science, Interfacial subjects and Instrumentation.

Course Learning Outcomes: Upon successful learning, students will be able to learn

Unit-I: Understanding on advances in research, innovations and modern technology.

Unit-II: Knowledge of relevant literature on and around the subject.

Unit-III: Designing experiments for a desired goal.

Unit-IV: Concluding the experimental outcomes.

Unit-V: Science, Technology & Innovations, in service of Society.

Suggested readings:

M.Sc. Chemistry semester IV CHE-DSM-423A Organic Synthesis, Drug design & Medicinal Chemistry		
Credits : 6		
UNIT I-V	Dissertation in Chemistry	180 Hrs 180

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Scheme of M.Sc. Program in Chemistry under CBCS system
Objectives and Learning Outcomes of M.Sc. Chemistry Course

Class	Subject	Semester	Course Code	Course Title	Marks	Credit
M.Sc.	Chemistry	Fourth	CHE-DSM-423B	Laboratory Course: Inorganic, Organic and Physical Chemistry	Mid Sem: 40 End Sem = 60	06

Course Objectives: Advance knowledge of spectroscopy and other instrumental techniques.
Course Learning Outcomes: Upon successful learning, students will be able to learn
1. Photometric estimation of molecules and ions.
2. Multistep synthesis and separation of molecules.
3. Understanding enzymatic reactions.
4. Applications of electroanalytical techniques.
5. Understanding of basic electronic system.

Suggested readings:

- Inorganic Experiments, J. Derek Woolins, VCH
- Microscale Inorganic Chemistry. J. Szafran, R. M. Pike, and M.M. Singh, Wiley
- Practical Inorganic Chemistry, G. Marr and B.W. Rockett, Van Nostrand
- The systematic identification of organic compounds, R. L. Sriner and D. Y. Curtin
- Semimicro qualitative organic analysis, N.D. Cheronis, J. B. Entrikin and E.M. Hodnett
- Experimental Organic Chemistry, M. P. Doyle and W.S. Mungall
- Organometallic Synthesis, J. J. Fisch and R.B. King, Academic
- Experimental Physical Chemistry, D. P. Shoemaker, C. W. Garland, and J.W. Niber, McGraw Hill Interscience
- Findley's Practical Physical Chemistry, revised B.P. Levitt, Longman
- Experiments in Physical Chemistry, J. C. Ghosh, Bharti Bhavan.

M.Sc. Chemistry semester III

CHE-DSM-423B

Laboratory Course –Inorganic Chemistry, Organic Chemistry and Physical Chemistry

Credits : 6

Unit	Experiments of Inorganic Chemistry	60 Hrs
Unit I	Instrumentation : Spectrophotometry Mn/Cr/V in steel sample ; Ni/Mo/W/V/U by extractive spectrophotometric method.; Fluoride / nitrite / phosphate.; Iron-phenanthroline complex: Job's method. Zirconium-Alizarin Red-S complexes: Mole-ratio method.; Copper-Ethylene diamine complexes: Slope-ratio method.	12
Unit II	Nephelometric determination. Sulphate,Phosphate,Silver pH-metric and Conductometric study of metal-complexes.	12
Unit III	(II) Flame photometric determinations Na and K when present together. Li/Cd/Ba/Sc. Cd and Mg in tap water.	12
Unit IV	Flame photometric determinations Na and K when present together. Li/Cd/Ba/Sc, Cd and Mg in tap water.	12
Unit V	Chromatographic separation : Paper Chromatography: Mixture of cations/ anions viz. Cd and Zn, Zn and Mg etc. ,Thin-layer chromatographic-separation of Ni, Mn, Co, Zn etc.. Determination of Rfvalues.	12
Unit	**Experiments of organic Chemistry**	**60 Hrs**
Unit I	Identification of organic compounds by the analysis of their spectral data (UV, IR,PMR, CMR & MS).	12
Unit II	Multi-step Synthesis of Organic Compounds The exercises should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques. Benzophenone→ Benzpinacol→Benzpinacolone Beckmann rearrangement: Benzanilide from benzene Benzene→ Benzophenone→Benzophenoneoxime→Benzanilide Benzilic acid rearrangement: Benzilic acid from benzoin Benzoin→ Benzil→Benzilic acid	12
Unit III	Enzymatic synthesis Enzymatic reduction: Reduction of ethyl acetoacetate using Bakersyeast to yield enantiomeric excess of S (+) ethyl-3-hydroxybutanoate and determine its optical purity. Biosynthesis of ethanol from sucrose.	12
Unit IV	Synthesis using phase transfer catalyst. Alkylation of diethyl malonate or ethyl acetoacetate with an alkyl halide.	12
Unit V	Paper Chromatography Sepration and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of Rf values. Spectroscopy **Spectrophotometric (UV/VIS) Estimations** Amino acids, Proteins , Carbohydrates, Cholesterol, Ascorbic acid, Aspirin, Caffeine	12

Unit	Experiments of Physical Chemistry	60 Hrs
Unit I	**Polarography:** Determination the HWP of metal ions.	12
Unit II	Estimation of Pb^{2+} and Cd^{2+}/ Zn^{2+} and Ni^{2+} ions in mixture of Pb^{2+} and Cd^{2+} /Zn^{2+} and Ni^{2+} by polarography.	
Unit III	Quantitative determination of electroactive species by Polarography	
Unit IV	Determination of dissolved oxygen in aqueous solution of organic solvent. Determination of the amount of Pb^{2+} by standard $K_2Cr_2O_7$ solution amperometrically.	
Unit V	**Basic Electronics :** • Measurement of resistance with multimeter and testing of components by multimeter Measurement of resistance of a given ammeter • Voltage measurement with CRO • Familiarizing CRO	

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Objectives and Learning Outcomes of M.Sc. Chemistry

Department of Chemistry						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	Chemistry	Fourth	CHE-MDM-421	Organic Synthesis, Drug design & Medicinal Chemistry	Mid Sem: 40 End Sem = 60	04

Course Objectives: Advance knowledge of spectroscopy with electronic properties and band theory.

Course Learning Outcomes: Upon successful learning, students will be able to learn

Unit-I: Synthesis and properties of metal mediated and metal based substances.

Unit-II: Important rearrangement organic reactions.

Unit-III: disconnection approach and ring synthesis.

Unit-IV: important aspects of drug design

Unit-V: Pharmacokinetics and pharmacodynamic aspects of Organic drugs & Metallodrugs .

Suggested readings:

- Modern Synthetic reactions, H. O. House, W. A. Benzamin
- Principles of Organic Synthesis, R.O.C. Norman, and J.M. Coxon, Blackie Academics and Professionals
- Advanced Organic Chemistry, Reaction mechanisms and structure, J. March, John Wiley
- Advanced Organic Chemistry, Part-B, F.A. Carey and R.J. Sundberg, Plenum Press
- Introduction of Medicinal Chemistry, A. Gringuage, Wiley-VCH
- Wilson and Giswod's textbook of organic medicinal and pharmaceutical chemistry, Ed. Robert F. Dorge
- An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age International
- Burger's Medicinal Chemistry and Drug Discovery (Vol. I, Ch 9 and 14), Ed. M.E. Wott, John-Wiley.
- The organic chemistry of drug design and drug action, R.B. Silverman, Academic Press.

M.Sc. Chemistry semester IV

CHE-MDM-421

Organic Synthesis, Drug design & Medicinal Chemistry

Credits : 4

		60 Hrs
UNIT I	**Organo-metallic substances**: Principle, preparations, properties and applications of the following in organic synthesis with mechanistic details. Group I and II metal organic compounds: Li, Mg, Zn and Ce compounds; Transition metals: Cu, Fe, Rh and Ti compounds. Other elements Si and B.	12
UNIT II	**Rearrangements** General mechanistic considerations- nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements Pinacol-pinacolone, Wagner-Meerwein, Demjanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Beckmann, Hofman, Curtius, Schmidt, Baeyer-Villiger, Shapiro reaction.	12
UNIT III	**Disconnection approach** An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reactions, amine synthesis. **Two Group C-C disconnections** Diels-Alder reaction, α,β-unsaturated carbonyl compounds, Micheal addition and Robinson annelation. **Ring synthesis** Aromatic heterocycles in organic synthesis, Synthesis of Cortisone, Vitamin-D and Juvabione.	12
UNIT IV	**Drug design** Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure-activity relationship (SAR), factors affecting bioactivity, resonance, inductive effect, isosterism, bio-isosterism, spatial considerations. Theories of drug activity: occupancy theory, rate theory, induced fit theory. Quantitative structure activity relationship (QSAR). History and development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters; lipophilicity, partition coefficient, electronic ionization constants, steric, Shelton and surface activity parameters and redox potentials. Free-Wilson analysis, Hansch analysis, relationships between Free-Wilson and Hansch analysis. LD-50, ED-50 (Mathematical derivations of equations excluded). Chemical background of antineoplastic agents, cardiovascular drug, antibiotics, antiinfective and psychoactive drugs	12
UNIT V	**Pharmacokinetics & Pharmacodynamics** Important pharmacokinetic parameters in defining drug disposition in therapeutics. Uses of pharmacokinetics in drug development process. drug metabolism, xenobiotics, biotransformation. Significance of drug metabolism in medicinal chemistry. **Metals in Medicine**: Metal deficiency and disease, toxic effects of metals, metals used for diagnosis and chemotherapy with particular reference to anticancer drugs.	12

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Department of Chemistry						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	Chemistry	Fourth	CHE-SEC-421A	Analytical Chemistry	Mid Sem: 40 End Sem = 60	03

Course Objectives: To provide knowledge about the basics of chemical analysis with special emphasis on quantitative analysis. Also to learn about the various common analytical instrumental techniques.

Course Learning Outcomes: Basic understanding about the classical and analytical instrumental techniques. It will help learners to understand new analytical methods as well as characterization of different samples. To train for professional job opportunities in various industries.

Unit-I: The basic principles of analytical chemistry.

Unit-II: Optical and thermal analytical instrumentation.

Unit-III: Electrochemistry & Electroanalytical Instrumentation; applications.

Unit-IV: Principle and uses of separation & identification by Chromatography.

Unit-V: Understanding of Radiochemical and Advanced Microscopic techniques.

Suggested Readings:

- Analytical Chemistry by Gary D. Christian
- "Fundamentals of Analytical Chemistry" by Skoog, West, Holler and Crouch
- "Analytical Chemistry: An Introduction" by Gary Holmes and Laurie D. D. Kasper
- "Principles of Instrumental Analysis" by Douglas A. Skoog and F. James Holler
- "Instrumental Analysis" by Skoog, Holler, and Crouch
- "Quantitative Chemical Analysis" by Daniel C. Harris
- Instrumental methods of Analysis by Willard, Merritt, Dean, Settle

M.Sc. Chemistry semester IV CHE-SEC-421A Analytical Chemistry		
Credits : 4		45 Hrs
UNIT I	**Basic Chemical Analysis:** Analytical chemistry and chemical analysis, Classification of analytical methods; Classical & Instrumental, Method selection, Sample processing, Steps in a quantitative analysis, Acid base titrations and theory of pH indicators, Complexation equilibria and complexometric titrations, Redox equilibria and redox titration, Theory of redox indicators, Precipitation reaction and precipitation titrations and theory of adsorption indicators.	9
UNIT II	**Instrumental methods of analysis:** Classification; UV-Vis spectrophotometry-Fundamental law of photometry, Photometric precision & Accuracy, Fluorescence and fluorescence lifetime measurements, Flame emission and atomic absorption spectroscopy –Basic principles, Instrumentation, qualitative and quantitative analysis Thermo-analytical methods: thermogravimetric analysis, Thermogravimetric analysis (TGA); differential thermal analysis (DTA): temperature difference and differential scanning calorimetry (DSC)	9
UNIT III	**Electro Analytical Techniques:** Fundamentals of electrochemistry and electrochemical cells, Current potential relationships, General treatment and applications of the following techniques: AC polarography ; Pulse Polarography, NPP and DPP, Anodic stripping voltammetry and cyclic voltammetry , Spectro-elctrochemistry. Photo-electrochemical reduction of CO_2.	9
UNIT IV	**Chromatographic Techniques**: Classification; Basic principle, Chromatographic retention (parameters for column and planar techniques) Technique and Mechanism, peak shape and zone broadening, measurement of chromatographic parameters. General principle and working of TLC, HPTLC, HPLC and GC; Basic idea of Hyphenated techniques.	9
UNIT V	**Radiochemical Methods & Microscopic Techniques:** Nuclear reactions and Radiations, Neutron sources, Activation analysis, isotope dilution analysis **Microscopy:** Principle, instrumentation and applications of -Transmission electron microscope (TEM), Scanning electron microscope (SEM), Atomic force Microscopy (AFM), EDAX, Photoelectron spectroscopy	9

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Department of Chemistry						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	Chemistry	Fourth	CHE-SEC-EC-421B	Photo-inorganic, Radioactivity & Radiation Chemistry	Mid Sem: 40 End Sem = 60	03

Course Objectives: Advance knowledge of Photoinorganic, electronic transitions, Radiation chemistry and biology.

Course Learning Outcomes: Upon successful learning, students will be able to learn

Unit-I: Basics of photochemistry.

Unit-II: Chemistry of excited states of metal complexes and their redox behaviour

Unit-III: Applications of fluorescence and phosphorescence

Unit-IV: Hazards of nuclear radiations and their safety aspects.

Unit-V: Nuclear Chemistry, and radioactive waste management.

Suggested readings:

- Concept of Inorganic Photochemistry, A. W. Adamson, and P. D. Flewischauer, Wiley
- Inorganic Photochemistry, J. Chem. Educ. Vol. 60(10), 1983
- Photochemistry of Coordination compounds, V. Balzari and V. Carassiti, Academic Press
- Coordination Chem. Revs. 1981, vol 39, 121, 131; 1975, 15, 321, 1990, 97, 313
- Essentials of Nuclear Chemistry, H. J. Arnikar, New Age International.
- Nuclear and Radiochemistry, Fundamentals and applications, Jenz-Volker Kratz, Karl Heinrich Lieser, Wiley-VCH

M.Sc. Chemistry semester IV

CHE-SEC-421B

Photo-inorganic, Radioactivity & Radiation Chemistry

Credits : 3 — 45 Hrs

UNIT I	**Basics of Photochemistry:** electronically excited states, Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages- primary and secondary processes. **Properties of Excited States** Structure, dipole moment, acid-base strengths, reactivity. Photochemical kinetics-calculation of rates of radiative processes. Bimolecular deactivation- quenching. **Excited State of Metal Complexes** Excited State 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.	9
UNIT II	**Redox reactions by Excited Metal Complexes** Energy transfer under conditions of weak interaction and strong interaction-exciplex formation; condition of the excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2'-bipyridine and 1,10-phenthroline complexes), illustration of reducing and oxidizing character of Ruthenium^{2+}(bipyridal complexes), comprasion with $Fe(bipy)_3$;	9
UNIT III	Role of spin orbital 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. Metal Complexes Sensitizers, Metal complex sensitizer, water photolysis, and nitrogen fixation and carbon dioxide reduction.	9
UNIT IV	Radiation hazards and safety; Natural and manmade sources of radiations, internal and external radiation hazards, safe handling methods, personal dosimetry, reactor safety, radiation protecting materials. Biological effects of radiations: The interaction of radiations with biological cells, various stages, somatic and genetic effects, maximum permissible dose-ICRP recommendations.	9
UNIT V	Applications of radioisotopes in nuclear medicine and pharmaceuticals: general applications of radiopharmaceuticals, use of nuclear properties of indicator nuclides, Use of radiation for food preservation and sterilization. Radioactive waste management: Introduction, Classification of radioactive waste, Origin of Radioactive waste, Treatment of Radioactive wastes: Radioactive waste disposal.	9

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Department of Chemistry						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	Chemistry	Fourth	CHE-SEC-422	Instrumental Methods of Analysis	Mid Sem: 40 End Sem: 60	01

Course Objectives: Advance knowledge of spectroscopy with electronic properties and band theory.

Course Learning Outcomes: Upon successful learning, students will be able to interpret:

Unit-I: Thermogram

Unit-II: Voltammogram

Unit-III: Chromatogram

Unit-IV: PL spectra

Unit-V: Optical Sensing

Suggested readings:

- Instrumental Analytical Chemistry: An Introduction, James W. Robinson, Eileen M. Skelly Frame, George M. Frame II, CRC Press.
- Chemistry Experiments for Instrumental Methods, D.T. Sawyer, W.R. Hieneman, and J.M. Beebe, John Wiley and Sons.
- Experiments in Analytical Chemistry, AVR Reddy, K. K. Swain, K. Venkatesh, Association of Environmental Analytical Chemistry of India.

M.Sc. Chemistry semester IV CHE-SEC-421B Instrumental Methods of Analysis		
Credits : 1		30 Hrs
Unit I	Analysis of TGA, DTA and DSC curves	6
Unit II	Analysis of voltammogram	6
Unit III	Analysis of chromatogram obtained from liquid chromatography and gas chromatography	6
Unit IV	Fluorescence and life time analysis	6
Unit V	Sensing of hazardous molecules by photochemical, Uv-Vis methods.	6