

## MSc -Inorganic Chemistry-2020-21

Odd Sem	MSc 1st Sem	MSc 3rd Sem
Nov 2-7,2020	Def init ions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Symmetry elements and symmetry operation,	Chemical composition of water bodies - lakes, streams, rivers and wet lands, Hydrological cycle.
Nov 9-14,2020	Def init ions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Symmetry elements and symmetry operation,	Wa ter pollution – inorganic, organic , pesticide, agr icultural, industrial and sewage, detergents , oil spills and oil pollutants.
Nov. 16-21,2020	Character of a representation, reducible and irreducible representations,The grea t orthogonality theor em (without proof) and its importance, De rivation ofchara cter tables of C2 v, C3 v and D2 h Cha ra cter tables and their use.	Wa ter quality parameters – dissolved oxygen, biochemical oxygen demand, solids, metals, cont ent of chloride, sulphate, phosphate, nitrate and micro-organisms. Water quality standards.
Nov. 23-28,2020	Molecula rasymmetry, dissymmetry and optica l activity.	Chemical composition of atmosphere – particles, ions and radicals and their formation, Chemical and photochemical reactions in atmosphere, smog formation
Nov 30- Dec. 5,2020	VSEPR Theory, Wa lsh diagrams (tri- a tomic molecules ), d p-p p bonds,	oxides of N, C, S and their effect, pollut ion by chemicals, petroleum, minerals, chlorofluorohydrocarbons. Green house effect, acid rain, air pollution controls and their chemistry.

Dec 7-12,2020	Bent rule and energetics of hybridization, Huckel theory with reference to ethylene and butadiene,	Metal Ions in Biological Systems Essential and trace metals. Na <sup>+</sup> /K <sup>+</sup> Pump Role of metals ions in biological processes
Dec. 14-19,2020	Some simple substitution reactions of covalently bonded molecules of boron, silicon and nitrogen.	Heme proteins and oxygen uptake, structure and function of hemoglobin, myoglobin, hemocyanins and hemerythrin model synthetic complexes of iron and cobalt
Dec 21-26, 2020	Stepwise and overall formation constants and the interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand,	Structure and function of metalloproteins in electron transport processes - cytochromes and iron-sulphur proteins, synthetic models.
Dec. 28 2020- Jan 2,2021	chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry and spectrophotometry.	General principles, diffusion controlled current, Ilkovic equation, Half-wave potentials, overpotential, theories of hydrogen overvoltage
Jan 4-9,2021	Substitution reactions in octahedral complexes, theories of trans effect with respect to Pt(II) complexes	Tafel's theory / Recombination theory and Volmer, Erdy & Gruss theory / theory of slow discharge of ions
Jan. 11-16,2021	brief account of electron transfer reactions, inert and labile complexes.	Symmetry and shapes, and no. of IR modes AB <sub>2</sub> , AB <sub>3</sub> , AB <sub>4</sub> , AB <sub>5</sub> and AB <sub>6</sub> (Group Theoretical treatment) mode of bonding of ambidentate ligands and diketonato complexes,

Jan 18-23, 2021	Limitation of crystal field theory, crystal field effects,	application of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins
Jan 25-30, 2021	John Teller distortion, nephelauxetic series, spin-orbital coupling,	Mössbauer Spectroscopy, Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of bonding and structures of Fe <sup>2+</sup> and Fe <sup>3+</sup> compounds including those of intermediate spin,
Feb 1-6, 2021	molecular orbital theory of octahedral, tetrahedral and square planar complexes	Sn <sup>2+</sup> and Sn <sup>4+</sup> compounds – nature of M-L bond, coordination number, structure and detection of oxidation state
Feb 8-13, 2021	Doubts Classes	Photoelectron Spectroscopy, Basic principles; photo-electric effect, ionization process, Koopman's theorem.
Feb 15-20, 2021	Revisions	Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA.

Even Sem	MSc 2nd Sem
April 15-17, 2021	Electronic arrangements of microstates, calculation of the number of microstates in various electronic arrangements, spectroscopic term symbols,
April 19-24, 2021	vector diagrams to indicate coupling of orbital angular momenta in p <sup>2</sup> , p <sup>3</sup> , d <sup>2</sup> configurations and spin orbit coupling for p <sup>2</sup> arrangement,
April 26- May 1, 2021	spectroscopic terms, spectral terms of d <sup>2</sup> to d <sup>8</sup> metal ions, determining the ground state terms -Hund's rules, derivation of the term symbol for a closed subshell.
May 3-8, 2021	Interpretation of electronic spectra, Orgel diagrams,

May 10-15,2021	Tanabe-Sugano diagrams for transition metal complexes (d1 -d9 states) ,
May 17-22,2021	calculations of Dq, B and b parameters,charge transfer spectra,
May 24-29,2021	spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information,
May 31- June 5,2021	anomalous magnetic moments, magnetic exchange coupling and spin crossover.
June 7-12,2021	Circular Dichroism and Optical Rotatory Dispersion
June 14-19, 2021	Polarized light, fundamental symmetry requirements, for optical activity, interaction of polarized light with optically active matter,
June 21-26,2021	optical rotation, Cotton effect,configuration of Tris -chelated complexes.
June 28- July 3,2021	Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation,
July 5-10,2021	important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl,dinitrogen and dioxygen complexes; tertiary phosphine as ligand.
11-15july,2021	Higher boranes,
15-20 july,2021	carboranes, metaboranes and metallocarboranes. Metal carbonyl and halide clusters, compounds with metal-metal multiple bonds.

### MSc -Physical Chemistry-2020-21

Odd Sem	MSc 1st Sem	MSc 3rd Sem
Nov 2-7,2020	Recapitulation of thermodynamic laws. Concept of fugacity, methods for determining the fugacity of a real gas, its variation with temperature and pressure	Electromagnetic radiation, Interaction of electromagnetic radiation with matter- absorption, emission , transmission, reflection, refraction, dispersion, polarization and scattering. Uncertainty relation and natural line width and line broadening

Nov 9-14,2020	Activity, choice of standard states, dependence of activity on temperature and pressure, determination of activity by (i) measurement of vapour pressure, (ii) distribution of solute between two immiscible solvents, (iii) emf measurement and (iv) activity of one component from known value of the activity of the other.	Transition probabilities, results of the time dependent perturbation theory, transition moment, selection rule, intensity of spectral lines, Born-Oppenheimer approximation
Nov. 16-21,2020	Partial molar quantities, chemical potential and Gibbs-Duhem equation, variation of chemical potential with temperature and pressure, chemical potential for an ideal gas, chemical potential in ideal gas mixture,	Rotational, vibrational and electronic energy levels, The rotation of molecules, rotational spectra of rigid diatomic molecules
Nov. 23-28,2020	Determination of partial molar volume, thermodynamic functions of mixing (free energy, entropy, volume and enthalpy), concept of escaping tendency and chemical potential.	Intensities of rotational spectral lines, isotopic effect, non-rigid rotator, spectra of polyatomic linear molecules and symmetric top molecules.
Nov 30- Dec. 5,2020	Collision theory of reaction rates, the steric requirement, Arrhenius equation and activated complex theory (ACT), comparison of collision and activation complex theory, Potential energy surfaces (Only basic Idea), thermodynamic formulation of activated complex theory,	The vibrating diatomic molecule, force constant, zero point energy, simple harmonic vibrator, anharmonicity, Morse potential, overtones, hot bands, diatomic vibrating rotators, P,Q,R branches,
Dec 7-12,2020	Chain reactions (hydrogen-halogen reaction), unimolecular reactions, Lindemann – Hinshelwood mechanism of unimolecular reactions.	Vibration of polyatomic molecules, normal mode of vibrations. Fourier transform spectroscopy. Classical and quantum theories, pure rotational Raman spectra of linear molecules,

Dec. 14-19,2020	Debye-Hückel theory of ion-ion interaction and activity coefficient, applicability and limitations of Debye-Hückel limiting law, its modification for finite-sized ions, effect of ion-solvent interaction on activity coefficient, Physical significance of activity coefficients,	Vibrational Raman spectra, mutual exclusion principle, polarization of the light and Raman effect, depolarization of Raman lines, technique.
Dec 21-26, 2020	Mean activity coefficient of an electrolyte, Debye-Huckel-Onsager (D-H-O) theory of electrolytic conductance , Debye - Falkenhagen effect, Wein effect.	Basic principles of NMR, theory of nuclear magnetic resonance, spin lattice relaxation, spin-spin relaxation, experimental techniques chemical shift,the $\delta$ -scale of chemical shift, the origin of shielding constant, pattern of coupling , origin of spin-spin coupling, the nuclear overhauser effect.
Dec. 28 2020- Jan 2,2021	D-H-O equation - its applicability and limitations, Pair-wise association of ions (Bjerrum treatment), Modification of D-H-O theory to account for ion-pair formation.	Basic principles of ESR, experimental technique, the g -value hyperfine structure, applications of ESR spectroscopy to the study of free radicals and fast reactions, spin densities and Mc Connell relationship.
Jan 4-9,2021	Metal/Electrolyte interface, Concept of electrical double layer and its structure: Helmholtz-Perrin , Gouy-Chapman, and Stern models, electrokinetic phenomena,determination of zeta potential.	Basic principles of NQR, experimental techniques, Zeeman effect in NQR spectra, quadrupole interactions in molecules, applications.
Jan. 11-16,2021	Gibbs adsorption equation, Langmuir adsorption isotherm and its kinetic derivation for non-dissociative and dissociative adsorption,	Symmetry elements in crystals, criteria for determining unit cell of lattice, stereographic projections, point groups (illustration of R, R-bar, Rm, R/m, R-bar/m point groups only), miller indices for planes

Jan 18-23, 2021	BET adsorption isotherm, its kinetic derivation and applications, Study of surfaces by STM, SEM.	Space lattices, space groups P1, Pbar1, P2, P21, Pm, Pc, Cc, C2, Cm, C2/m. Defects in crystal. Derivation of equilibrium concentration of Schottky and Frenkel defects.
Jan 25-30, 2021	Heterogeneous catalysis, surface heterogeneity, surface catalyzed unimolecular and bimolecular reactions,	Production of X-rays, X-ray spectra, absorption edges, X-ray filters, Reciprocal lattice concept and its importance, Definition of Reciprocal lattice vector. Interplanar spacing using reciprocal lattice concept for cubic, tetragonal, orthorhombic and hexagonal crystal systems.
Feb 1-6, 2021	Temporary and permanent catalytic poisons, activation energy for surface reactions. Comparison of homogeneous and heterogeneous reaction rates.	Equivalence of Bragg's and Laue condition. Structure factor calculations for primitive, base-centered, body-centered and face centered unit cells. Relation of structure factor to electron density and intensities
Feb 8-13, 2021	Revision	Data collection and data reduction, Phase problem –Patterson method and Heavy-atom method, refinement of structure by successive and difference fourier synthesis. Correctness of a structure (Discrepancy index).
Feb 15-20, 2021	Revision, Class Test	Electron diffraction: Basics, Measurement technique, Comparison with X-ray diffraction technique. Applications in structure determination. Neutron diffraction: Basics, measurement techniques, Applications and comparison with X-ray diffraction technique.

Even Sem	MSc 2nd Sem
April 15-17, 2021	The postulates of quantum mechanics, Linear and Hermitian operators, Commutation of operators and Uncertainty Principle, Schrodinger equation

April 19-24,2021	Eigen function and eigen values, free particle, Schrodinger equation for a particle in a box, the degeneracy, particle in a box with a finite barrier
April 26- May 1,2021	Schrodinger equation for linear harmonic oscillator and its solution, zero point energy, Tunneling Problem: Tunneling through a rectangular barrier.
May 3-8 ,2021	Energy levels and wave-functions of Rigid rotator, Hydrogen atom: Complete solution (separation of variables in spherical polar coordinates and its solution).
May 10-15,2021	Radial distributions, Angular momentum and its directional quantization, Angular momentum operators, commutation relation
May 17-22,2021	Revision of Basic concepts, Kinetics of Polymerization: Mechanism and Kinetics of chain growth polymerization: free-radical, cationic, anionic and coordination polymerization.
May 24-29,2021	Mechanism and Kinetics of step-growth polymerization. Comparison between step-growth and chain polymerization.
May 31- June 5,2021	Molecular mass of polymers: Significance of average molecular mass, Poly-dispersity, Molecular mass distribution curves, Determination of molecular mass by osmometry and viscosity methods.
June 7-12,2021	Electrically conducting polymers, Fire resistant polymers, Liquid crystal polymers.
June 14-19, 2021	Nuclear stability and binding energy. Mass and binding energy, Nuclear fission and nuclear fusion,
June 21-26,2021	Fission cross section, chain fission, fission product and fission yield. Interaction of nuclear radiation with matter,
June 28- July 3,2021	Detectors (Proportional, Geiger-Muller and Scintillation counters) and their principles. Units for measuring radiation absorbed, radiation dosimetry
July 5-10,2021	Doubt Session
11-15july,2021	Radiotracer technique, Activation analysis, isotope dilution technique,
15-20 july,2021	Radiochromatography, radiometric titrations, Neutron absorptiometry, Some applications
	Revision of Syllabus
	Class test
	Revision

## MSc -Organic Chemistry-2020-21



Odd Sem	MSc 1st Sem	MSc 3rd Sem	MSc 3rd Sem	MSc 3rd Sem
2021-2022	Paper -III	Paper - XIV	Paper -XV	Paper -XVI
Nov 2-7,2020	Types of mechanisms , types of reactions, thermodynamic and kinetic requirements, effect of structure on reactivity - Resonance and field effects,	Various electronic transitions (185 -800 nm), Beer Lambert law, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds,	Principle , preparations, properties and applications of the reagents of the following metals/non-metals in organic synthesis with mechanistic details Li, Mg, Cd, Zn,	Molecular orbital symmetry, frontier orbital of ethylene , 1,3-butadiene, 1,3,5 - hexatriene and allyl system classification of pericyclic react ions,
Nov 9-14,2020	steric effect , quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants.	Fieser-Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heterocyclic compounds. Steric effect in biphenyls.	Principle , preparations, properties and applications of the reagents of the following metals/non-metals in organic synthesis with mechanistic details, B and I	Woodward - Hoffmann correlation diagram. FMO & PMO approach, Electrocyclic reaction - conrotatory and disrotatory motions. 4n, 4n+2, allyl systems,
Nov. 16-21,2020	Taft equation, kinetic & thermodynamic control, Hammond's postulate, Curtin - Hammett principle .	Instrumentation and sample handling. Characteristic vibrational frequencies of alkanes, alkenes, alkynes , aromatic compounds, alcohols, ethers, phenols and amines.	Principle , preparations, properties and applications of the reagents of the following metals in organic synthesis with mechanistic details Pd, Ni, Fe	Ring opening of cyclopropyl halides and tosylates, cycloadditions-antarafacial and suprafacial additions,
Nov. 23-28,2020	Potential energy diagrams , transition states and intermediates, methods of determining mechanisms	Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters , amides , acids, anhydrides, lactones, lactams and conjugated carbonyl compounds)	Principle , preparations, properties and applications of the reagents of the following metals in organic synthesis with mechanistic details Cr and Ti	4n and 4n+2 systems , 2+2 addition of ketenes, 1,3 -dipolar cycloadditions and cheletropic Reactions.

		. Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones , combination bands and Fermi resonance.	compounds	
Nov 30- Dec. 5,2020	Generation, structure ,stability and reactivity of carbocations,carbanions, carbenes and nitrenes.	FTIR, IR of gaseous,solids and polymeric materials .General introduction and de finition, chemical shift,spin-spin interaction,shielding mechanism,mechanism of measurement,	Introduction.Different oxidative process es.Hydrocarbons-alkenes, aromatic rings,	Sigmatropic Rearrangements-suprafacial and entarafacial shifts of H, sigma tropic shifts involving carbon moieties,
Dec 7- 12,2020	limiting cases SN1 and SN2, detailed mechanistic description \$ border line mechanisms, nucleophilicity and solvent effects, competition between nucleophilicity \$ basicity, ambident nucleophiles,	chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols , phenols, enols , carboxylic acids , amines, amides & mercapto), complex spin-spin interaction between two, three, four and five nuclei (first order spectra),	saturated C-H groups (activated and unactivated) . Alcohols, diols, aldehydes, ketones,	retention and inversion of configuration, [3,3] and [5,5] sigmatropic rearrangements, detailed treatment of Sommelet-Hauser ,
Dec. 14- 19,2020	hard and soft nucleophiles and electrophiles, leaving group effects, steric and other substituent effects on substitution and ionization rates, stereochemistry of nucleophilic substitution, SNi , SN1 ' , SN2 ' and SNi' mechanisms.	spin system-Pople notation, virtual coupling. Stereochemistry, concept of topicity, effect of enantiomeric and diastereomeric protons, hindered rotation, Karplus curve - variation of coupling constant	ketals and carboxylic acids .Amines, hydrazines, and sulphides .	Claisen and Cope rearrangements introduction to ene reactions. Simple problems on Pericyclic reactions , Group transfers and eliminations.

		with dihedral angle		
Dec 21-26, 2020	The E1, E1cB and E2 mechanism, Orientation Effects in Elimination Reactions, Saytzeff and Hoffman rules, Stereochemistry of E2 Elimination Reaction and Eclipsing Effects in E2 Eliminations.	Fourier transform technique, Resonance of other nuclei -F, P. Further tools for simplification (chemical and instrumental) and elucidate structures by NMR including an overview of 2D NMR Techniques- Deuteration, changing solvents, trifluoroacetylation,	.Oxidations with ruthenium tetroxide, and thallium (III) nitrate.	Excitation and excited states, Franck-Condon Principle, Jablonski diagram, energy transfer photosensitization, quenching, quantum efficiency and quantum yield.
Dec. 28 2020-Jan 2, 2021	Symmetry elements, D-L, R-S, E-Z and threo-erythro nomenclature, interconversion of Fischer, Newman, Sawhorse and flying wedge formulae. conformational analysis,	basic cation and acidification, shift reagents, spin decoupling, COSY, DEPT, INEPT, HETCOR, HSQC, HMBC and NOESY.	Introduction. Different reductive processes	Photochemistry of carbonyl compounds (Norrish type I and type II changes, photoreaction of cyclic ketones,
Jan 4-9, 2021	enantiomerism and diastereomerism of simple, cyclic (chair and boat configuration) and acyclic systems. Axial and planar chirality, optical isomerism in allenes,	Introduction, ion product ion - EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional group,	Hydrocarbons – alkanes, alkenes, alkynes and aromatic rings. Carbonyl compounds	Paterno-Buchi reaction and Photoreduction. Photochemistry of olefins and 1,6-Butadiene (cis-trans isomerisation, dimerisation and cycloadditions). Chemistry of vision.
Jan. 11-16, 2021	biphenyls (atropisomerism), spiranes, hemispiranes. elementary ideas about stereochemistry of tertiary amines, quaternary salts, sulphur and phosphorous compounds.	molecular ion peak, metastable peak, Nitrogen rule, molecular weight determination molecular formula from isotopic ratio data,	Carbonyl compounds – aldehydes, ketones,	Di-p-methane rearrangement, enone and dienone rearrangements,

Jan 18-23, 2021	Topicity of ligands and faces, their nomenclature and prostereoisomerism, stereogeneity, chirogenicity	isotope profile of halogen compounds, factors affecting reaction pathways, fragmentation pattern - simple cleavage, retroDiels Alder,	acids and their derivatives. Epoxides. Nitro, nitroso, azo and oxime groups. Hydrogenolysis, Books	photochemistry of aromatic compounds (substitution, isomerization, cyclization and cycloaddition)
Jan 25-30, 2021	pseudoasymmetry and prochiral centre. stereospecific and stereoselective reaction.	Hydrogen transfer rearrangement like scrambling, ortho effect, McLafferty rearrangement, fragmentation patterns of hydrocarbons, alcohols, phenols, ethers, aldehydes, ketones, esters,	Principle, preparations, properties and applications of the reagents of the following metals in organic synthesis with mechanistic details Co, Rh, compound	Photo-Fries rearrangement, photolysis of nitrile esters
Feb 1-6, 2021	Elementary idea of principle categories of asymmetric synthesis, Cram's rule and its modification, Prelog rule and Horeaus rule	carboxylic acids, amines, nitro, amides, nitriles.	Principle, preparations, properties and applications of the reagents of the following metals/non-metals in organic synthesis with mechanistic details B and I	Barton reaction, Hoffman-Loeffler-Freytag reaction.
Feb 8-13, 2021	Stereochemistry of sugars- C1 and 1C conformations of hexoses, c 2'-endo and c3'-endo conformation of pentoses,	General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon),	Introduction. Different oxidative processes. Hydrocarbons- alkenes, aromatic rings,	Application of photochemistry- photosynthesis, phototherapy.
Feb 15-20, 2021	homomorphous sugars, abnormal mutarotation and $\Delta$ -2 instability factor. Stereochemistry of decalins.	coupling constants. nuclear Overhauser effect NOE Problems pertaining to sections A, B and C.	saturated C-H groups (activated and unactivated). Alcohols, diols, aldehydes, ketones,	Simple problems on Pericyclic reactions, Group transfers and eliminations

	Revisions	Revisions	Revisions	Revisions
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Even Sem	MSc 2nd Sem	MSc 4th Sem	MSc 4th Sem	MSc 4th Sem	MSc 4th Sem
2017-2018	Paper(VII)	Paper(XVII)	Paper(XVIII)	Paper(XIX)	Paper (XX)
April 15-17, 2021	Theoretical treatment of aromatic substitution reactions, structure-reactivity	An introduction of synthons and synthetic equivalents, general principles of the disconnection approach, functional group interconversions	A detailed study including mechanism or Arndt-Eistert synthesis Beckmann,	Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power,	Classification and discovery of new drugs, history and development of chemotherapeutic agents, therapeutic index, LD50 and ED50, naming of (new) drugs.
April 19-24, 2021	relationship in mono substituted benzene ring, orientation in other ring system, energy profile diagram, Vilsmeier-Haack reaction, Reimer-Tiemann reaction,	the importance of order of events in organic synthesis, one group C-X and two group C-X disconnections	Hofmann, Curtius, Lossen, Schmidt, Favorskii, Neber,	specificity and regulation. Nomenclature and classification, extraction and purification.	Elementary idea about drug action: the receptor role, neurotransmitters and receptors, ion channels and their control, membrane bound enzymes-activation/deactivation,
April 26-May 1, 2021	Mechanism of Nucleophilic substitution in aromatic systems via diazonium ions, by addition-elimination and elimination-addition mechanism (involving arynes);	the importance of order of events in organic synthesis, one group C-X and two group C-X disconnections	Fritsch-Butenberg-Wiechell, Baeyer-Villiger,	Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling.	chemical basis of messenger induced change of shape by the receptor, design of agonists, antagonists and partial agonists
May 3-8, 2021	Richter rearrangement, Sommelet-Hauser and Stevens rearrangements. General aspects of genera	Reversal of polarity, amine synthesis, Synthesis of alkenes -use of Wittig reagents, use of acetylene and	Benzilbenzilic acid rearrangements.	Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of	Drug development: screening of natural products, isolation and purification, structure determination, structure-activity relationships

	tion, structure, stability and reactivity of arynes	aliphatic nitro compounds in organic synthesis		inhibitors, affinity labeling.	(SAR),
May 10-15, 2021	Bimolecular mechanisms - SE2 and SEi. The SE1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates	synthesis of three membered rings, photochemistry in organic synthesis- synthesis of four membered rings,	A detailed study including mechanism Darzens synthesis, stroke enamine synthesis,	Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion	synthetic analogues, isosteres and bioisosteres, concept of lead compounds. Brief overview of pharmacokinetics and pharmacodynamics, concept of prodrugs and synergism.
May 17-22, 2021	Leaving group and the solvent polarity on the reactivity. Neighbouring Group Participation and Carbocation Rearrangements Anchimeric assistance, neighbouring group participation by non-bonding electrons, sigma and p-bonds, classical and non-classical carbocation, carbocations rearrangements, migratory aptitudes, Wagner Meerwein rearrangement	synthesis of three membered rings, photochemistry in organic synthesis- synthesis of four membered rings,	Shapiro reaction; Sharpless asymmetric epoxidation, Prevost and Woodward hydroxylation	Mechanism of action of chymotrypsin, carboxypeptidase A and papain.	Antineoplastic Agents: Mechlorethamine, Chlorambucil, cyclophosphamide, ca rmustine, aminopterin, 6-mercaptopurine, paclitaxel (synthesis of paclitaxel excluded)
May 24-29, 2021	pinacol pinacolone rearrangement, Demjanov rearrangement, Tiffeneau-Demjanov ring expansion, aldehyde-ketone rearrangement, dienone-phenol rearrangement and trans-annular rearrangements.	synthesis of three membered rings, photochemistry in organic synthesis- synthesis of four membered rings,	Flavonoids Occurrence, nomenclature, general (chemical and spectroscopic) methods of structure determination of flavonoids	Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A,	Antimalarials: Chloroquine, primaquine, chloroquine, pyrimethamine, Analgesics, Antipyrics and Antiinflammatory agents: Morphine and related compounds (codeine and heroin),
May 31-	General aspects of generation, structure, stability and	1,3-difunctionalized compounds and	Isolation and synthesis of Cyanin, Quercetin,	thiamine pyrophosphate, pyridoxal	meperidine, methadone, aspirin, a

June 5,2021	reactivity of free radicals, types of free radical reactions	unsaturated carbonyl compounds, control in carbonyl condensations,	Diadzein and Chrysin	phosphate, NAD <sup>+</sup> , NADP <sup>+</sup> , FMN, FAD,	cetaminophen, indomethacin, phenylbutazone, mefenamic acid, ibuprofen, diclofenac, naproxen, celecoxib.
June 7-12,2021	General aspects of generation, structure, stability and reactivity of free radicals, types of free radical reactions	difunctionalized compounds- Michael addition, and Robinson Annulation.	Biosynthesis of Flavonoids : Acetate pathway and Shikimic acid pathway, biosynthesis of catechin.	Mechanisms of reactions catalyzed by the above cofactors	Antifertility agents: Ovulation inhibitors and related hormonal contraceptives - norethindrone, norethynodrel, estetrol, mestranol, non-hormonal contraceptive - centchroman (synthesis of all the drugs excluded).
June 14-19, 2021	coupling of alkynes, homolytic aromatic substitution, Sandmeyer reaction and Hunsdiecker reaction.	disconnection approach towards the synthesis of Juvabione and their relative merits and demerits.	Systematic (Hantzsch-Widman) nomenclature for monocyclic and fused ring systems. Methods of synthesis	Prostaglandins : General Introduction, nomenclature and biological roles of prostaglandins. Synthesis of PGE <sub>2</sub> and PGF <sub>2</sub> α.	Cardiovascular Drugs: Calcium channel blockers and beta-blockers : sorbitrate, diltiazem, atenolol and verapamil
June 21-26,2021	Hydration and Addition of Alcohols to Aldehydes, Ketones and Acids. Addition-Elimination Reactions of Ketones and Aldehydes	Basic Principle and need of green chemistry, Different tools for green synthesis (Elementary idea of green reagent, green solvent,	Reactions including mechanism of the following. Five-membered heterocycles:	General aspects of structure determination of terpenoids,	AIDS and drugs against HIV: How HIV infects the system, structure and mode of action of important drugs against HIV (nucleoside reverse transcriptase inhibitors) - AZT, ddI, ddC, d4T and 3TC (synthesis only of AZT).
June 28-July 3,2021	Reactivity of carbonyl compounds towards Addition. Mannich Reaction, lithium aluminium hydride,	Basic Principle and need of green chemistry, Different tools for green synthesis (	pyrazole, imidazole, oxazole, isoxazole, thiazole, isothiazole; the ir basic	structure and synthesis of Geraniol, alpha-terpineol,	Cell wall biosynthesis and protein synthesis inhibitors: Penicillins and semi-

	reduction of carbonyl compounds	Elementary idea of green reagent, green solvent,	character		synthetic penicillins, synthesis,
July 5-10, 2021	acids, esters, nitriles, additions of Grignard reagents. Reformatsky reaction, Wittig reaction, Claisen condensation	synthesis involving basic principle of green chemistry-synthesis of adipic acid and BHC synthesis of Ibuprofen	Methods of synthesis of the following six-membered heterocycles	a-pinene, camphor and squalene	structure elucidation and medicinal uses of penicillin G, problems of sensitivity to acids, beta-lactamases and narrow spectrum of activity, solving these problems leading to the development of penicillin V,
11-15 July, 2021	Dieckmann reaction, Aldol condensation	An idea of supramolecular chemistry	pyrimidines and purines. Aromaticity, Metallocenes and Nonbenzenoid Aromatics Compounds Aromaticity	Biogenetic isoprene rule and biogenesis of terpenoids.	oxacillin, cloxacillin, ampicillin, amoxicillin, carbenicillin and carfecillin. Cephalosporins - Discovery, structure elucidation and synthesis of cephalosporin -C.
15-20 July, 2021	Knoevenagel condensation, Perkin reaction, Cannizzaro reaction, Benzoin condensation, Robinson-Mannich reaction	An idea of supramolecular chemistry	aromatic, non-aromatic, and antiaromatic), aromaticity in charged rings, homoaromaticity, pseudo-aromaticity	Steroids Isolation and nomenclature of steroids,	Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation,
	Ester hydrolysis, aminolysis of esters, amide hydrolysis	Crown ethers, cryptates,	HMO and PMO for determining aromatic, non-aromatic and anti-aromatic character of annulenes	structure, synthesis (Woodward) and stereochemistry of cholesterol	general methods of structure elucidation, degradation,
	Revision	micelles	having various p-electron systems, application of <sup>1</sup> H-NMR in determining aromatic	methods for the following conversions. i) Cholesterol <sup>®</sup> Testosterone	classification based on nitrogen heterocyclic ring, role of alkaloids in plants.



			character of annulenes.	ii) Cholesterol <sup>®</sup> Progesterone	
	Test	Revision, Test	General considerations, synthesis and reactions of representative compounds Ferrocene, Azulene, Tropones and Tropolones.	iii) Cholesterol <sup>®</sup> 5-a and 5-b cholanic acids. iv) Johnson's hydrochrysen approach towards the synthesis of, Androsterone .	Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine, (+)-Coniine, Nicotine, Quinine and Reserpine. Books Suggested

## MSc

Odd Sem	MSc 1st Sem Mathematics	MSc 1st Sem Life Sciences
Nov 2-7,2020	Examples of scalar and vectors, definitions of vectors in two, three spaces, representation and simple properties of vectors, addition and subtraction of vectors, vector addition by the method of triangles ,	Structure of prokaryotic and eukaryotic cells , intracellular organelles and their functions, comparison of plant and animal cells.
Nov 9-14,2020	resolution of vectors into rectangular components, addition of vectors by components,	Overview of metabolic processes -catabolism and anabolism. ATP - the biological energy currency. Carbohydrate metabolism-glycolysis,
Nov. 16-21,2020	multiplication and differentiation of vectors . Scalar product of vectors, vector product , concept of normalization, orthogonality and complete set of unit vectors.	Kreb's cycle, glycogenolysis, glycogenesis pentose phosphate
Nov. 23-28,2020	Illustration of applications to spectroscopy and quantum chemistry.	pathway and gluconeogenesis ,

Nov 30- Dec. 5,2020	Definit ion of matr ix, types of ma trices, viz . row matrix, column ma tr ix,null matrix, square matrix, diagonal matrix, addition, subtra ction and mult iplicat ionby a number, matrix mult iplication.	Structure and functions of important derivatives of monosaccharides like
Dec 7-12,2020	Transpose and adjoint of matr ix, elementary transforma tion, r epresentation and applications (without deve lopment of theory) tosolution of linea r equa tions. Definition of determinant,	glycosides , deoxy sugars, myoinositol
Dec. 14-19,2020	properties of determinants, evaluation of determinants. Illust ration or applicat ions to group theory, problems inchemistry.	amino sugars-N-acetylmuramic acid and sialicacid, disaccharides Structure and biological functions of Structural polysaccharides - cellulose and
Dec 21-26, 2020	Need for logarithm in chemist ry. Theory and application of logar ithms forsolving genera l and chemical problems.	chitin.Storage polysacchar ides -star ch and glycogen. Heteropolysacchides-glucosaminoglycans
Dec. 28 2020- Jan 2,2021	Rectangular coordinates, straight lines, slope and interc ept of the equa tion,slope and point equation, two point equation,	mucopolysacchaides .Glycoconjugates- glycoproteins and glcolipids.
Jan 4-9,2021	paralle l lines , points of intersection, distance between two points, change of or igin.Examples from problems in chemistry, curve f itting for least squares method.	Role of suga rs in biological recognition. Blood group substances.

<p>Jan. 11-16, 2021</p>	<p>The binomial expansion, some example from chemistry, sines, cosines and tangents, trigonometric identities, polar coordinates in trigonometric functions</p>	<p>Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol,</p>
<p>Jan 18-23, 2021</p>	<p>Theory, rules of differentiation, powers, added and subtracted functions, constants, products, quotients, functions of a function, logarithmic differentiation, and parametric functions. Algebraic simplification, differentiation of implicit functions, graphical significance of differentiation,</p>	<p>Bile acids, prostaglandins. Lipoproteins - composition and function, role in atherosclerosis.</p>
<p>Jan 25-30, 2021</p>	<p>rate of change of slope, successive differentiation. Examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution. Exact and inexact differentiation with their application to thermodynamic principles.</p>	<p>Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure.</p>
<p>Feb 1-6, 2021</p>	<p>The fundamental theorem, geometrical significance of partial differentiation, special cases of fundamental theorem, successive partial differentiation. Integral transforms (Fourier and Laplace). Reduction formulae, application to chemical problems. Methods of Lagrangian multipliers, Sterling's approximation, probability and errors.</p>	<p>Essential amino acids, Isoelectric pH, chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins, forces responsible for holding of secondary structures. <math>\alpha</math>-helix, <math>\beta</math>-sheets, supersecondary structure, triple helix structure of collagen.</p>

Feb 8-13,2021	<p>Integral theory, rules of integration between limits, significance of 'e'</p> <p>exponential equations, methods of integration, viz . algebraic simplifications, substitution, integration by parts, integration by partial fractions, coordinate transformation (e.g., cartesian to spherical polar), curve sketching, integral as area.</p> <p>Illustration of application in chemistry. Evaluation of standard integrals used in chemistry.</p>	<p>Tertiary structure of protein- folding and domain structure. Quaternary structure . denaturation of proteins</p> <p>Nucleic Acids and Genetic Code</p> <p>Structure of nucleotides, nucleosides, DNA (Watson-Crick model) RNA structure and conformation,</p>
Feb 15-20, 2021	<p>Simple differential equations, separable variables, homogeneous equations, exact equations, linear equations, equation of the first and second order, partial differential equation, application to physico-chemical problems.</p>	<p>Replication of DNA (semi-conservative, conservative and dispersive replication</p> <p>Meselson-Stahl experiment) , transcription, translation of genetic material, genetic code, universality of the code, codon, anticodon pairing, RNA, protein biosynthesis</p> <p>(initiation elongation, termination and processing of the peptide chain).</p>

## MSc

Even Sem	MSc 2nd Sem Computer
April 15-17, 2021	Elementary Aspects of computer , memory size/architecture. Binary, octal & hexadecimal number systems. Using Internet, word processing package; Graphics Package and visualization.
April 19-24,2021	Introduction to Operating system (UNIX, Windows) and programming language. Algorithm, Flow charts. Writing simple programs, converting a flow chart into a program.
April 26- May 1,2021	Using graphics package plotting (a) $y = x, x^2, \sin(x), \tan(x)$ (b) wavefunctions for s, p, and d – orbitals.
May 3-8 ,2021	Numerical Methods: Roots of Polynomials, Solution of Linear simultaneous equations, matrix multiplication and inversion.
May 10-15,2021	Numerical differentiation and integration. Statistical treatment of data , variance and correlations, linear

	regression
May 17-22,2021	Using ChemDraw. Writing programs for van der Waals equation, pH titration, kinetics, radioactive decay,
May 24-29,2021	evaluation of lattice energy and ionic radii from experimental data.
May 31- June 5,2021	Elementary structural features such as bond lengths,
June 7-12,2021	Elementary structural features such as bond lengths, bond angles, dihedral angles et c.
June 14-19, 2021	of molecules extracted from a database such as Cambridge database. numerical problem on data base
June 21-26,2021	numerical problem on data base
June 28- July 3,2021	chem draw molecular representation on computer
July 5-10,2021	polynomials programme determination on computer
11-15july,2021	Doubt session
15-20 july,2021	Revisions

  
**HEAD**  
**Chemistry Department**  
**Dyal Singh College, KARNAL**