GUJRANWALA GURU NANAK KHALSA COLLEGE, CIVIL LINES, LUDHIANA

AFFILIATED TO PANJAB UNIVERSITY, CHANDIGARH

Academic Calendar for the session 2019-20 with Under Graduate & Post Graduate Chemistry Course having Semester System of examination:-

SummerVacation	**31-05-19**	**To**	**07-07-19**	**(38 days)**
	Friday		**Sunday**	

Academic Calendar

Colleges Open on and normal Admission for on-going Classes	**08-07-19 Monday**			

Admission Shedule

Admission Process	**08-07-19 Monday**	**To**	**13-07-19 Saturday**	**(06 days)**
Normal Admission for New classes (except for those Classes in which admission is Through PU-CET(U.G.))	**15-07-19 Monday**	**To**	**27-07-19 Saturday**	**(12 days)**

Late Admission for, ongoing Classes and new classes) to be allowed by the Principal of the College with late fee of Rs.**560/**- per student.	**29-07-19** **Monday**	**To**	**13-08-19** **Tuesday**	**(16 days)**

Commencement of Teaching

Admission for classes through CET tentative	**Schedule to be provided by Dean Faculty of Science**			
For new admission classes (those admitted through PU-CET (P.G) tentative	**As per CET**			
Late admission in Panjab University, affiliated Colleges to be allowed by the Vice-Chancellor with fee of Rs. 2040/-per student	**14-08-19** **Wednesday**	**To**	**31-08-19** **Saturday**	**(18 days)**

Academic Term –I **08-07-19** **To** **29-11-19** **(97 teaching days)**

Ist,3rd,Vth **Monday** **Friday**

Total teaching days of Academic Term I = 97 Days

Bachelor of Sciences				**Session 2019-20 (First Semester)**			
S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Dr. Geeta Jallan	B.Sc.-I	Paper-III Physical Chemistry-A	July	IIIrd	**UNIT-I Mathematical Concepts and Evaluation of Analytical Data :** Logarithmic relations, curve sketching, linear graphs and calculation of slopes	**UNIT-I (8 Hrs.)** **Mathematical Concepts and Evaluation of Analytical Data :** Logarithmic relations and calculation of slopes, differentiation and integration of functions like ex, xn, sin x, log x; maxima and minima, partial differentiation and reciprocity relations. Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods, improving accuracy of analysis, data treatment for series involving relatively few measurements, linear least squares curve fitting, types of errors, standard deviation. **UNIT-II (7Hrs.)** **Gaseous States:** Postulates of kinetic theory of gases, deviation from ideal behavior, Van der Waal's equation of state. **Critical Phenomena :** PV isotherms of real gases, continuity of states, the isotherms of Van der Waal's equation, relationship between critical constants and Van der Waal's constants, the law of corresponding states, reduced equation of state. **Molecular Velocities :**Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect). **UNIT-III (8 Hrs.)** **Chemical Kinetics-I :** Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction-concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of
					IVth	Differentiation and integration of functions like ex, xn, sin x, log x	
				August	Ist	Maxima and minima, partial differentiation and reciprocity relations	
					IInd	Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods	

					III[rd]	Improving accuracy of analysis, data treatment for series involving relatively few measurements, linear least squares curve fitting, types of errors, standard deviation.	rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction – differential method, method of integration, method of half life period and isolation method. Radioactive decay as a first order phenomenon. **Chemical Kinetics-II :** *Theories of Chemical Kinetics:* Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Catalysis and general characteristics of catalytic reactions, Homogeneous catalysis, acid-base catalysis and enzyme catalysis including their mechanisms, MichaelisMenten equation for enzyme catalysis and its mechanism.
					IV[th]	**UNIT-II** **Gaseous States:** Postulates of kinetic theory of gases, deviation from ideal behavior, Van der Waal's equation of state. **Critical Phenomena :** PV isotherms of real gases,	
					V[th]	Continuity of states, the isotherms of Van der Waal's equation, relationship between critical constants and Vander Waal's constants	
				September	II[nd]	The law of corresponding states, reduced equation of state. **Molecular Velocities:** Root mean square, average and most probable velocities.	
					III[rd]	Qualitative	

						discussion of the Maxwell's distribution of molecular velocities, collision number,	
					IVth	Mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect).	
					Vth	**Chemical Kinetics-I :** Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction-concentration,	
				October	IInd	Temperature, pressure, solvent, light, catalyst. Concentration dependence of rates mathematical characteristics of simple chemical reactions – zero order first order, pseudo order, half life and mean life.	
					IIIrd	Determination of the order of reaction – differential method,	
					IVth	Method of integration, method	

						of half life period and isolation method. Radioactive decay as a first order phenomenon. **Chemical Kinetics-II :** *Theories of Chemical Kinetics:* Effect of temperature on rate of reaction,	
					Vth	Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis).	
				November	Ist	Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Catalysis and general characteristics of catalytic reactions, Homogeneous catalysis,	
					IInd	Acid-base catalysis and enzyme catalysis including their mechanisms, MichaelisMenten equation for enzyme catalysis and its	

						mechanism	
2.	Prof. Ruchika	B.Sc-I	Paper-II Organic chemistry-A	July	III[rd]	**UNIT-I Structure and Bonding :** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Vander Waals interactions,	**UNIT-I (8 Hrs.)** **Structure and Bonding :** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding. **Mechanism of Organic Reactions :** Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates—Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies). **UNIT –II (7 Hrs.)** **Alkanes and Cycloalkanes:** Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes Mechanism of free radical halogenation of alkanes: Orientation, reactivity and selectivity. Cycloalkanes – nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitation. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds **UNIT-III (8 Hrs.)** **Stereochemistry of Organic Compounds I:** Concept of isomerism, Types of isomerism. Optical isomerism – Elements of symmetry, molecular chirality, enantiomers, stereogeniccenter, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccenters, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. **UNIT-IV (7 Hrs.)** **Stereochemistry of Organic Compounds II :** Geometric isomerism: Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism—Conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono and disubstituted cyclohexane derivatives.
					IV[th]	Resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.	
				August	I[st]	**Mechanism of Organic Reactions :** Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents electrophiles and nucleophiles.	
					II[nd]	Types of organic reactions. Energy considerations. Reactive intermediates—Carbocations, carbanions, free radicals, carbenes,	

						arynes and nitrenes (with examples).	Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.
					III[rd]	Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).	
					IV[th]	**UNIT- II Alkanes and Cycloalkanes:** Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes	
				September	I[st]	Mechanism of free radical halogenation of alkanes: Orientation, reactivity and selectivity. Cycloalkanes – nomenclature,	

						methods of formation, chemical reactions	
					II[nd]	Baeyer's strain theory and its limitation. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds	
					III[rd]	**UNIT-III Stereochemistry of Organic Compounds I:** Concept of isomerism, Types of isomerism. Optical isomerism – Elements of symmetry, molecular chirality, enantiomers, stereogeniccenter,	
					IV[th]	Optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccenters, diastereomers, threo and erythrodiastereomers, meso compounds,	
					V[th]	Resolution of enantiomers,	

						inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.	
				October	IInd	**UNIT-IV Stereochemistry of Organic Compounds II :** Geometric isomerism: Determination of configuration of geometric isomers. E & Z system of nomenclature	
					IIIrd	Geometric isomerism in oximes and alicyclic compounds. Conformational isomerism— Conformational analysis of ethane and n-butane;	
					IVth	Conformations of cyclohexane, axial and equatorial bonds, conformation of mono and disubstituted cyclohexane derivatives.	
				November	Ist	Newman projection and Sawhorse formulae, Fischer	

						and flying wedge formulae.	
					II[nd]	Difference between configuration and conformation	
3.	Prof. Ruchika	B.Sc.-I	Paper-I Inorganic Chemistry-A	July	III[rd]	**UNIT-I** **Atomic Structure :** Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Y and Y2	**UNIT-I (8 Hrs.)** **Atomic Structure :** Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Ψ and Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of *s, p, d* orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions. **UNIT-II (7 Hrs.)** **Periodic Properties :** Position of elements in the periodic table; effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electron affinity and electronegativity—definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour. **UNIT-III (7 Hrs.)** **Chemistry of Noble Gases and *s*-Block Elements :** Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds. Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls. **UNIT-IV (8 Hrs.)** **Chemical Bonding-I :**Covalent Bond – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, $SnCl_2$, XeF_4, BF^-_4, PF^-_6, $SnCl^{2-}_6$. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O+, SF_4, ClF_3, ICl^-_2 and H_2O. MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO,CN, CO^+, NO^+, CO, CN^-), diatomic molecules. Percentage ionic character from dipole moment and electronegativity difference.
					IV[th]	Quantum numbers, radial and angular wave functions and probability distribution curves	
				August	I[st]	Shapes of *s, p, d*orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.	
					II[nd]	**UNIT-II** **Periodic Properties :**Position of elements in the periodic table; effective nuclear charge and its calculations. Atomic and ionic radii,	

					III[rd]	Ionization energy, electron affinity and electronegativity—definition, methods of determination or evaluation,	
					IV[th]	Trends in periodic table and applications in predicting and explaining the chemical behaviour.	
					V[th]	**UNIT-III Chemistry of Noble Gases and *s*-Block Elements :**Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.	
				September	II[nd]	Comparative study, diagonal relationships, salient features of hydrides,	
					III[rd]	Solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.	
					IV[th]	**UNIT-IV Chemical Bonding-I :** Covalent Bond – Valence bond theory and its limitations,	

						directional characteristics of covalent bond,	
					V^{th}	Various types of hybridization and shapes of simple inorganic molecules and ions. BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, $SnCl_2$, XeF_4, BF^-_4, PF^-_6, $SnCl^{2-}_6$	
				October	II^{nd}	Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O+, SF_4, ClF_3, ICl^-_2 and H_2O.	
					III^{rd}	MO theory	
					IV^{th}	Homonuclear (elements and ions of 1st and 2nd row),	
					V^{th}	Heteronuclear (BO, CN, CO^+, NO^+, CO, CN^-)	
				November	Ist	Diatomic molecules. Percentage ionic character from dipole moment and electronegativity difference.	

Bachelor of Sciences Session 2019-20 Third Semester

S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Dr. Sivali Sharma	B.Sc.-II	Paper-XI Physical Chemistry-A	July	III[rd]	**UNIT-I Liquid State:** Intermolecular forces, structure of liquids (a qualitative description)	**UNIT-I (8 Hrs.)** **Liquid State:** Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. *Liquid Crystals :*Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell. **UNIT-II (7 Hrs.)** **Chemical Equilibrium:** Equilibrium constant and free energy. Thermodynamic derivation of law of mass of mass action. Le - Chatelier's principle. Reaction isotherm and Reaction isochore-Clapeyron equation and Clausius –Clapeyron equation, applications. **UNIT-III (8 Hrs.)** **Thermodynamics-II:** *Second Law of Thermodynamics:* Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. *Concept of Entropy:* Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. **UNIT-IV (7 Hrs.)** **Thermodynamics-III:** *Third Law of Thermodynamics:* Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz functions (A) as thermodynamic quantities, A &G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.
					IV[th]	Structural differences between solids, liquids and gases	
				August	I[st]	*Liquid Crystals :* Difference between liquid crystal, solid and liquid	
					II[nd]	Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.	
					III[rd]	**UNIT-II Chemical Equilibrium:** Equilibrium constant and free energy.	
					IV[th]	Thermodynamic derivation of law of mass of mass action. Le - Chatelier's principle.	
					V[th]	Reaction isotherm and Reaction isochore-Clapeyron equation and Clausius –Clapeyron equation, applications.	
				September	II[nd]	**UNIT-III Thermodynamics-II:**	

						Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle and its efficiency	
					III[rd]	Carnot theorem. Thermodynamic scale of temperature. *Concept of Entropy:* Entropy as a state function	
					IV[th]	Entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change	
					V[th]	Clausius inequality, entropy as a criteria of spontaneity and equilibrium.	
				October	II[nd]	Entropy change in ideal gases and mixing of gases.	
					III[rd]	**UNIT-IV Thermodynamics-III:** *Third Law of Thermodynamics:* Nernst heat theorem, statement and concept of residual entropy,	
					IVth	Evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions	
					V[th]	Gibbs function (G) and	

						Helmholtz functions (A) as thermodynamic quantities,	
				November	Ist	A &G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change.	
					IInd	Variation of G and A with P, V and T.	
2.	Prof.Ruchika	B.Sc-II	Paper-X Organic chemistry-A	July	IIIrd	**UNIT-I** **Alcohols and Phenols:** Classification and nomenclature	**UNIT-I (8 Hrs.)** **Alcohols and Phenols:** Classification and nomenclature. Monohydric alcohols-Nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric and Trihydric alcohols-Nomenclature, methods of formation, chemical reactions of vicinal glycols and glycerol. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, and Reimer-Tiemann reaction. **UNIT-II (8 Hrs.)** **Aldehydes and Ketones I** Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. **UNIT-III (7 Hrs.)** **Aldehydes and Ketones-II** Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaroreaction, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. **UNIT-IV** **Carboxylic Acids: (7 Hrs.)** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects
					IVth	Monohydric alcohols-Nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters	
				August	Ist	Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric and Trihydric alcohols-Nomenclature, methods of formation, chemical reactions of vicinal glycols and glycerol.	
					IInd	Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and	

						phenols, resonance stabilization of phenoxide ion	of substitutions on acid strength. Preparations of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids. Mechanism of decarboxylation.Methods of formation and chemical reactions of halo acids. Hydroxyl acids: Malic, tartaric and citric acids(structural features only). Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effects of heat and hydrating agents.
					III[rd]	Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement	
					IV[th]	Claisen rearrangement, Gatterman synthesis, and Reimer-Tiemann reaction.	
				September	I[st]	**UNIT-II Aldehydes and Ketones I** Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chorides,	
					II[nd]	Synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids, Physical properties.	
					III[rd]	**UNIT-III Aldehydes and Ketones-II** Mechanism of nucleophilic additions to carbonyl group with	

						particular emphasis on benzoin, aldol, Perkin andKnoevenagel condensations.	
					IVth	Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Use of acetals as protecting group	
					Vth	Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions.	
				October	IInd	**UNIT-IV** **Carboxylic Acids:** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substitutions on acid strength.	
					IIIrd	Preparations of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction	
					IVth	Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids.	
				November	Ist	Mechanism of decarboxylation.	

						Methods of formation and chemical reactions of halo acids. Hydroxyl acids: Malic, tartaric and citric acids (structural features only).	
					II[nd]	Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effects of heat and hydrating agents.	
3.	Prof. Ruchika	B.Sc.-II	Paper-IX Inorganic Chemistry-A	July	III[rd]	**UNIT-I** **Chemistry of Elements of First Transition Series:** Characteristic properties of *d*-block elements.	**UNIT-I (8 Hrs.)** **Chemistry of Elements of First Transition Series:** Characteristic properties of *d*-block elements. Properties of the elements of the first transition series, their simple compounds and complexes, illustrating relative stability of their oxidation states, coordination number and geometry. **UNIT-II (7 Hrs.)** **Chemistry of Elements of Second and Third Transition Series:** General characteristics, comparative treatment with their 3*d*-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry. **UNIT-III (8 Hrs.)** **Chemistry of Coordination Compounds-I** Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds **UNIT-IV (7 Hrs.)** **Chemistry of Coordination Compounds-II** Valence bond theory of transition metal complexes. Properties of Coordination compounds i.e. magenetic properties, colours (Qualitative approach only), use of coordination compounds.
					IV[th]	Properties of the elements of the first transition series, their simple compounds and complexes, illustrating relative stability of their oxidation states, coordination number and geometry.	
				August	I[st]	Properties of the elements of the first transition series, their simple compounds and complexes, illustrating relative stability of their oxidation states, coordination number	

						and geometry.	
					II[nd]	Properties of the elements of the first transition series, their simple compounds and complexes, illustrating relative stability of their oxidation states, coordination number and geometry.	
					III[rd]	**UNIT-II** **Chemistry of Elements of Second and Third Transition Series:** General characteristics	
					IV[th]	Comparative treatment with their 3*d*-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.	
					V[th]	Comparative treatment with their 3*d*-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.	
				September	II[nd]	**UNIT-III** **Chemistry of Coordination Compounds-I** Werner's coordination theory and its experimental verification	
					III[rd]	Effective atomic	

						number concept, chelates,	
					IVth	Isomerism in coordination compounds	
					Vth	Isomerism in coordination compounds	
				October	IInd	**UNIT-IV** **Chemistry of Coordination Compounds-II** Valence bond theory of transition metal complexes	
					IIIrd	Properties of Coordination compounds i.e. magenetic properties, colours (Qualitative approach only),	
					IVth	Properties of Coordination compounds i.e. magenetic properties, colours (Qualitative approach only),	
					Vth	Properties of Coordination compounds i.e. magenetic properties, colours (Qualitative approach only),	

Bachelor of Sciences (B.Sc.) Session 2019-20 (Fifth Semester)

S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Prof.Ruchika	B.Sc.-III	Paper-XVII Inorganic Chemistry	July	III[rd]	UNIT-I **Metal – Ligand Bonding in Transition Metal Complexes**: Limitations of valence bond theory, an elementary idea of crystal – field theory	UNIT-I (8 Hrs.) **Metal – Ligand Bonding in Transition Metal Complexes**: Limitations of valence bond theory, an elementary idea of crystal – field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal – field parameters, Spectro chemical Series. UNIT-II (7 Hrs.) **Thermodynamic and Kinetic Aspects of Metal Complexes** : A brief outline of thermodynamic and Kinetic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes. UNIT-III (8 Hrs.) **Organometallic Chemistry**: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al , Hg, Sn and Ti, a brief account of metal – ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls UNIT-IV (7 Hrs.) **Bioinorganic Chemistry**: Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions. Nitrogen fixation.
					IV[th]	Crystal field splitting in octahedral complexes	
				August	I[st]	Crystal field splitting in tetrahedral complexes	
					II[nd]	Crystal field splitting in square planar complexes, factors affecting the crystal – field parameters, Spectro chemical Series.	
					III[rd]	UNIT-II **Thermodynamic and Kinetic Aspects of Metal Complexes** : A brief outline of thermodynamic and Kinetic stability of metal complexes	
					IV[th]	Factors affecting the stability square planar complexes	
					V[th]	Factors affecting the substitution reactions of square planar complexes	
				September	II[nd]	UNIT-III **Organometallic Chemistry**: Definition,	

						nomenclature and classification of organometallic compounds.	
					III[rd]	Preparation, properties, bonding and applications of alkyls and aryls of Li, Al	
					IV[th]	Preparation, properties, bonding and applications of alkyls and aryls of Hg, Sn and Ti,	
					V[th]	A brief account of metal – ethylenic complexes and homogeneous hydrogenation,	
				October	II[nd]	Mononuclear carbonyls and the nature of bonding in metal carbonyls	
					III[rd]	UNIT-IV **Bioinorganic Chemistry**: Essential and trace elements in biological processes	
					IV[th]	Metalloporphyrins with special reference to haemoglobin and myoglobin.	
					V[th]	Biological role of alkali and alkaline earth metal ions.	

				November	Ist	Nitrogen fixation.	
2.	Prof Ruchika	B.Sc-III	Paper-XVIII Organic chemistry-A	July	IIIrd	UNIT-III **Spectroscopy**: Nuclear magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (^{1}H NMR) spectroscopy,	**UNIT-I** (7 Hrs.) **Heterocyclic Compounds**: Introduction : Molecular orbital picture and aromatic character of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed – five and six – membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis. Skraup synthesis and Bischler–– Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline. UNIT-II (7 Hrs.) **Electromagnetic Spectrum: Absorption Spectra-II**: Infrared (IR) absorption spectroscopy – Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques. UNIT-III (8 Hrs.) **Spectroscopy**: Nuclear magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, area of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. UNIT-IV (8 Hrs.) **Carbohydrates**: Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+) – glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose.An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.
					IVth	Nuclear shielding and deshielding, chemical shift and molecular structure,	
				August	Ist	Spin-spin splitting and coupling constants, area of signals	
					IInd	Interpretation of PMR spectra	
					IIIrd	Interpretation of ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.	
					IVth	Applications of NMR	
				September	Ist	UNIT-II **Electromagnetic Spectrum: Absorption Spectra-II**: Infrared (IR) absorption spectroscopy – Molecular vibrations, Hooke's law, selection rules	

					II[nd]	Intensity and position of IR bands, measurement of IR spectrum, fingerprint region,	
					III[rd]	Characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds	
					IV[th]	Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.	
					V[th]	UNIT-IV **Carbohydrates**: Classification and nomenclature. Monosaccharides	
				October	II[nd]	Mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers	
					III[rd]	Conversion of glucose into	

						mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+) – glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose	
					IVth	An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. UNIT-I **Heterocyclic Compounds**: Introduction : Molecular orbital picture	
				November	Ist	Aromatic character of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution.Mechanism of nucleophilic	

						substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.	
					IInd	Introduction to condensed – five and six – membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis. Skraup synthesis and Bischler-– Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.	
3.	Dr. Rishu Jain	B.Sc.-III	Paper-XIX Physical Chemistry	July	IIIrd	**UNIT-I Elementary Quantum Mechanics-I**: Black-body radiation, Planck's radiation law, photoelectric effect,	**UNIT-I (8 Hrs.)** **Elementary Quantum Mechanics-I**: Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions. **UNIT-II** (7 Hrs.) **Elementary Quantum Mechanics-II**:
					IVth	Heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its	

						defects, Compton effect. De Broglie hypothesis,	Molecular orbital theory, basic ideas – criteria for forming M.O. from A.O., construction of M.O.'s by LCAO – H_2^+ ion. Calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ*, π, π* orbitals and their characteristics. Hybrid orbitals – sp, sp^2, sp^3; calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H_2, comparison of M.O. and V.B. models. **UNIT-III** (8 Hrs.) **Photochemistry-I**: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of Photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state. **UNIT-IV** (7 Hrs.) **Photochemistry-II**: Qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples).Photochemistry of carbonyl compounds and alkenes.
				August	Ist	The Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance,	
					IInd	Physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.	
					IIIrd	Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance,	
					IVth	Hydrogen like wave functions, radial wave functions, angular wave functions.	
					Vth	**UNIT-II Elementary Quantum Mechanics-II**: Molecular orbital theory, basic ideas – criteria for forming	

						M.O. from A.O.,	
				September	IInd	Construction of M.O.'s by LCAO – H_2^+ ion. Calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions,	
					IIIrd	Conceptof σ, σ*, π, π* orbitals and their characteristics. Hybrid orbitals – sp, sp^2, sp^3; calculation of coefficients of A.O.'s used in these hybrid orbitals.	
					IVth	Introduction to valence bond model of H_2, comparison of M.O. and V.B. models. **UNIT-III Photochemistry-I**: Interaction of radiation with matter	
					Vth	Difference between thermal and photochemical processes. Laws of Photochemistry: Grothus – Drapper law, Stark – Einstein law,	
				October	IInd	Jablonski diagram depicting various	

						processes occurring in the excited state.	
					III[rd]	**UNIT-IV Photochemistry-II**: Qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing)	
					IVth	Quantum yield, photosensitized reactions – energy transfer processes (simple examples).	
					V[th]	Photochemistry of carbonyl compounds and alkenes.	

Master of Sciences		Session 2019-20					(I^{st} Semester)
S.No.	**Teacher**	**Class**	**Paper**	**Month**	**Week**		**Syllabus**
1.	Dr. Geeta Jallan	M.Sc.-I	CH-411 Inorganic Chemistry-I	August	I^{st}	**UNIT1** **Stereochemistry And Bonding In Main Group Compounds** VSEPR, Walsh diagrams (tri and tetra-molecules), dπ-pπ bonds, Bent rule and Energetics of hybridization	**UNIT 1 (15 Hrs.)** **Stereochemistry And Bonding In Main Group Compounds** VSEPR, Walsh diagrams (tri and tetra-molecules), dπ-pπ bonds, Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules. **UNIT 2 (15 Hrs.)** **Metal Ligand Bonding** Limitations of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, π bonding and molecular orbital theory. **UNIT3 (15Hrs.)** **Metal-Ligand Equilibria In Solution** Stepwise and overall formation constant and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH spectrophotometry. **Reaction Mechanism of Transition Metal Complexes-I** Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valance bond and crystal field theories, kinetics of octahedral substitution. **UNIT 4 (15Hrs)** **Reaction Mechanism of Transition Metal Complexes –II** Acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, reactions without metal-ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of substitution
					II^{nd}	Some simple reactions of covalently bonded molecules **UNIT 2** **Metal Ligand Bonding** Limitations of crystal field theory,	
					III^{rd}	Molecular orbital theory, octahedral,Tetrahedral**,** Square planar complexes	
					IV^{th}	π bonding and molecular orbital theory. **UNIT3** **Metal-Ligand Equilibria In Solution** Stepwise and overall formation constant and their interaction,	
					V^{th}	Trends in stepwise constants, factors affecting the stability of metal	

						complexes with reference to the nature of metal ion and ligand,	reaction, Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus Hush Theory, inner sphere type reactions.
				September	Ist	Chelate effect and its thermodynamic origin, determination of binary formation constants by pH spectrophotometry.	
					IInd	**Reaction Mechanism of Transition Metal Complexes-I** Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes,	
					IIIrd	Kinetic application of valance bond and crystal field theories, kinetics of octahedral substitution.	
					IVth	**Unit IV Reaction Mechanism of Transition Metal Complexes –II** Acid hydrolysis, Factors affecting acid hydrolysis,Base hydrolysis,	
				October	Ist	Conjugate base mechanism. Reactions	

						without metal-ligand bond cleavage	
					II[nd]	Substitution reactions in square planar complexes,	
					III[rd]	The trans effect, mechanism of substitution reaction Redox reactions,	
					IV[th]	Electron transfer reactions, mechanism of one electron transfer reactions	
					V[th]	Outer sphere type reactions, cross reactions	
				November	I[st]	Marcus Hush Theory	
					II[nd]	Inner sphere type reactions.	
3.	Dr. Gurpreet Kaur	M.Sc.-I	CH-412 Organic chemistry-II	August	I[st]	**UNIT 1** **Nature of Bonding in Organic Molecule** Delocalized chemical bonding, conjugation, Cross conjugation, resonance hyper conjugation	**UNIT 1 (15 Hrs.)** **Nature of Bonding in Organic Molecule** Delocalized chemical bonding, conjugation, Cross conjugation, resonance hyper conjugation, Bonding in fullerenes, Tautomerism, Aromaticity in benzenoid and non benzenoid compd. Alternant and non alternant hydrocarbons, Huckel's rule. Energy level of π M.O., Annulenes, anti aromaticity, aromaticity, Homo aromaticity, PMO approach. Bonds weaker than covalent, addition compound, crown ether complexes and cryptands, Inclusion compound, cyclo dextrins, Catenanes & rotaxanes. Effect of structure on reactivity-resonance and field effects, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation. **UNIT 2 (15 Hrs.)**
					II[nd]	Bonding in fullerenes, Tautomerism, Aromaticity in benzenoid and non benzenoid compd. Alternant and non alternant hydrocarbons	
					III[rd]	Huckel's rule. Energy level of π M.O., Annulenes, anti	

						aromaticity, aromaticity, Homo aromaticity	**Stereochemistry** Conformational analysis of cyclo alkanes, decalins, effect of confirmation on reactivity. Confirmation of sugars, Steric strain due to undesirable crowding of resolution, entatiotropic and diasterotropic atoms. Stereo specific and stereo selective synthesis, chirality due to helical shape. Stereochemistry of compounds containing N,S,P. **UNIT 3** **(10 Hrs.)** **Aliphatic Nucleophilic Substitution** The S_N2, S_N1, mixed S_N1 and S_N2 and SET mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, Classical and non-classical carbocations, norbornyl system. common carbocation rearrangements. The SNi mechanism. Nucleophilic substitution at an allylic, aliphatic, trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis, ambident nucleophile, regioselectivity. **Aliphatic Electrophilic Subsitution** **(5 Hrs.)** Biomolecular mechanisms-S_E2 and S_Ei. The S_E1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity. **UNIT 4** **(8 Hrs.)** **Aromatic Electrophilic Substitution** The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeyer reaction, Gattermann-Koch reaction. **Aromatic Nucleophilic Substitution**
					IVth	PMO approach. Bonds weaker than covalent, addition compound, crown ether complexes and cryptands, Inclusion compound	
					Vth	Cyclo dextrins, Catenanes & rotaxanes. Effect of structure on reactivity-resonance and field effects, steric effect, quantitative treatment.	
				September	Ist	The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation. **UNIT 2** **Stereochemistry** Conformational analysis of cyclo alkanes	
					IInd	Decalins, effect of confirmation on reactivity. Confirmation of sugars, Steric strain due to undesirable crowding of resolution	
					IIIrd	Entatiotropic and	

						diasterotropic atoms. Stereo specific and stereo selective synthesis, chirality due to helical shape. Stereochemistry of compounds containing N,S,P.	The S_NAr, S_N1, benzyne and $S_{RN}1$ mechanisms, Reactivity-effect of substrate structure, leaving group and attacking nucleophile. The Von Richter, Sommelet-Hauser and smiles rearrangements.
					IVth	**UNIT 3** **Aliphatic Nucleophilic Substitution** The SN2, SN1, mixed SN1 and SN2 and SET mechanisms. The neighbouring group mechanism	
				October	Ist	Neighbouring group participation by π and σ bonds, Classical and non-classical carbocations, norbornyl system. common carbocation rearrangements.	
					IInd	The SNi mechanism. Nucleophilic substitution at an allylic, aliphatic, trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium	

					III[rd]	Phase transfer catalysis, ambident nucleophile, regioselectivity. **Aliphatic Electrophilic Subsitution** Biomolecular mechanisms- S_E2 and S_Ei. The S_E1 mechanism,	
					IV[th]	Electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.	
					V[th]	**UNIT 4** **Aromatic Electrophilic Substitution** The arenium ion mechanism, orientation and reactivity, energy profile diagrams The ortho/para ratio, ipso attack, orientation in other ring systems.	
				November	I[st]	Quantitative treatment of reactivity in substrates and electrophiles.Diazonium coupling, Vilsmeyer reaction, Gattermann-Koch	

						reaction. **Aromatic Nucleophilic Substitution** The SNAr, SN1, benzyne	
					II[nd]	SRN1 mechanisms, Reactivity-effect of substrate structure, leaving group and attacking nucleophile The Von Richter, Sommelet-Hauser and smiles rearrangements.	
4.	Dr. Rishu Jain	M.Sc-I	CH-413 Physical Chmistry-I	August	I[st]	**UNIT 1** **Quantum Chemistry** Application of Schrodinger wave equation to particle in three dimensional box simple harmonic oscillator and rigid rotator.	**UNIT 1 (15 Hrs.)** **Quantum Chemistry** Application of Schrodinger wave equation to particle in three dimensional box, simple harmonic oscillator and rigid rotator. Approximate Methods: The variation theorem, Linear variation Principle, perturbation theory (first order, second order and Non degenerate), Applications of variation method and perturbation theory to the Helium atom. Self-Consistent-Field theory. **UNIT 2 (15 Hrs.)** **Angular Momentum:** Ordinary ang. momentum, generalized angular momentum, eigen functions for angular momentum, eigen values of angular momentum, operator using ladder operators, addition of angular-momenta, spin, anti symmetry and Pauli exclusion principle. **Molecular Orbital Theory :** Huckel theory of conjugated systems, bond order and charge density calculations, application to ethylene, allyl, butadiene, cyclopropenyl system, cylobutadiene etc. **UNIT 3 (15 Hrs.)** **Thermodynamics:**
					II[nd]	Approximate Methods: The variation theorem, Linear variation Principle, perturbation theory (first order, second order and Non degenerate),	
					III[rd]	Applications of variation method and perturbation theory to the Helium atom. Self-Consistent-Field theory	
					IV[th]	**UNIT 2** **Angular Momentum:** Ordinary ang. momentum,	

						generalized angular momentum, eigen functions for angular momentum, eigen values of angular momentum,	Classical Thermodynamics: Partial molal proporties, partial molal free energy, volume & heat content and their significance, Determination of these quantities, concept of fugacity and determination of fugacity. Non ideal systems, excess functions for non ideal solutions, Activity, Activity coeff, Debye huckel theory for activity coeff. electrolyte solutions, determination of activity & activity coeff, ionic strength. Application of phase rule to 3-component system, second order phase transitions. Statistical Thermodynamics: Concept of distribution, thermodynamic probability & most probable distribution, ensemble averaging, postulates of ensemble averaging, canonical, grand canonical & micro canonical ensembles. **UNIT 4 (15 Hrs.)** **Statistical Thermodynamics:** Corresponding distribution laws (using Lagrange's method of undetermined multipliers) Partition functions: Translational, Rotational, Vibrational, Electronic partitions functions. Calculation of Thermodynamic properties in terms of partition functions. Heat capacity, behavior of solids chemical equilibria and equilibrium constant in terms of partition function, F.D. statistics,distribution law and application to metals. Bose Einsteins statistics. Distribution law & application to Helium**.**
				September	Ist	Operator using ladder operators, addition of angular-momenta, spin, anti symmetry and Pauli exclusion principle.	
					IInd	**Molecular Orbital Theory :** Huckel theory of conjugated systems, bond order and charge density calculations, application to ethylene	
					IIIrd	Allyl, butadiene, cyclopropenyl system, cylobutadiene etc. **UNIT 3** **Thermodynamics:** Classical Thermodynamics: Partial molal proporties, partial molal free energy	
					IVth	Volume & heat content and their significance, Determination of these quantities, concept of fugacity and determination	

						of fugacity. Non ideal systems, excess functions for non ideal solutions,	
				October	Ist	Activity, Activity coeff, Debye huckel theory for activity coeff. electrolyte solutions, determination of activity & activity coeff, ionic strength.	
					IInd	Application of phase rule to 3-component system, second order phase transitions. Statistical Thermodynamics: Concept of distribution, thermodynamic probability & most probable distribution	
					IIIrd	Ensemble averaging, postulates of ensemble averaging, canonical, grand canonical & micro canonical ensembles.	
					IVth	**UNIT 4** **Statistical Thermodynamics:** Corresponding distribution laws (using Lagrange's method of undetermined multipliers)	
					Vth	Partition functions:	

						Translational, Rotational, Vibrational, Electronic partitions functions. Calculation of Thermodynamic properties in terms of partition functions.	
				November	Ist	Heat capacity, behavior of solids chemical equilibria and equilibrium constant in terms of partition function, F.D. statistics,	
					IInd	Distribution law and application to metals. Bose Einsteins statistics. Distribution law & application to Helium**.**	

Master of Sciences		Session 2019-20					(Third Semester)
S.No.	**Teacher**	**Class**	**Paper**	**Month**	**Week**		**Syllabus**
1.	Dr. Arwinder Kaur	M.Sc-II	CH-514 Environmental Chemistry-IV	July	III[rd]	**UNIT 1 Environment** Introduction.composition of atmosphere Vertical temperature, heat budget of the Earth atmospheric system.	**UNIT 1 (6 Hrs)** **Environment** Introduction. Composition of atmosphere, vertical temperature, heat budget of the Earth atmospheric system, vertical stability atmosphere. Biogeochemical cycles of C,N,P,S and O. Biodistribution of elements. **Environmental Toxicology (9 Hrs.)** Chemical solutions to environmental problems, biodegradability, principles of decomposition,better industrial processes. Bhopal gas tragedy, Chernobyl, Three mile island, Sewozo **UNIT 2 (15 Hrs.)** **Industrial Pollution** Cement sugar, distillery, drug, paper, thermal power plants, nuclear Power plants, metallurgy. Polymers, drugsetc. Radionuclide analysis. Disposal of wastes and their management and Minamata disasters. **Soils** Composition, micro and macro nutrients, pollution-fertilizers, pesticides, plastic and metals. Waste treatment **UNIT 3 (15 Hrs.)** **Hydrosphere** Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle. Aquatic pollution – inorganic, organic, pesticide, agricultural, industrial and Sewage, detergents, oil spills and oil pollutants. Water Quality parameters –Dissolved oxygen, biochemical oxygen demand, solids, metals, content of Chloride, sulphate,
					IV[th]	Vertical stability atmosphere. Biogeochemical cycles of C,N,P,S and O. Biodistribution of elements.	
					V[th]	**Environmental Toxicology** Chemical solutions to environmental problems, biodegradability, Principles of decomposition,	
				August	I[st]	Better industrial processes. Bhopal gas tragedy, Chernobyl, Three mile island, Sewozo	

					II[nd]	**UNIT 2** **Industrial Pollution** Cement sugar, distillery, drug, paper, thermal power plants, nuclear Power plants, metallurgy	phosphate, nitrate and micro-organisms. Water quality Standards. Analytical methods for measuring BOD, DO, COD, F, Oils, metals (As,Cd,Cr, Hg,Pb,Se etc.), residual chloride and chlorine demand. Purification and treatment of water. **UNIT 4** **(15 Hrs.)** **Atmosphere** Chemical composition of atmosphere–particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of Chlorofluorohydrocarbons, Ozone depletion, Global warming. Green house effect, acid rain, air pollution controls and their chemistry. Analytical methods for measuring air pollutants. Continuous monitoring instruments.
					III[rd]	Polymers, drugsetc. Radionuclide analysis, Disposal of wastes and their management	
					IV[th]	Minamata disasters, Composition, micro and macro nutrients	
				September	I[st]	Pollution-fertilizers, pesticides, Plastic and metals. Waste treatment	
					II[nd]	**UNIT 3** **Hydrosphere** Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle.	
					III[rd]	Aquatic pollution – inorganic, organic, pesticide, agricultural, industrial and Sewage,	

						detergents, oil spills and oil pollutants.	
					IVth	Water Quality parameters –Dissolved oxygen, biochemical oxygen demand, solids, metals,	
				October	Ist	Content of Chloride, sulphate, phosphate, nitrate and micro-organisms. Water quality Standards	
					IInd	Analytical methods for measuring BOD, DO, COD, F, Oils, metals (As,Cd,Cr, Hg,Pb,Se etc.), residual chloride and chlorine demand	
					IIIrd	Purification and treatment of water. **UNIT 4** **Atmosphere** Chemical composition of atmosphere – particles, ions and redicals and their formation.	
					IVth	Chemical and photochemical reactions in atmosphere, smog formation, oxides of	

						Chlorofluorohydrocarbons,	
					Vth	Ozone depletion, Global warming. Green house effect, acid rain, air pollution controls and their chemistry.	
				November	Ist	Analytical methods for measuring air pollutants. Continuous monitoring instruments.	
3.	Dr. Rishu Jain	M.Sc-II	CH-513(II) Heterocyclic Chemistry	July	IIIrd	**UNIT 1** **Nomenclature of Heterocycles** Replacement and systematic nomenclature (Hantzsch-widman System) for Monocyclic fused and bridged hetrocycles	**UNIT 1** **(4 Hrs.)** **Nomenclature of Heterocycles** Replacement and systematic nomenclature (Hantzsch-widman System) for monocyclic fused and bridged hetrocycles **Aromatic Heterocycles** **(5 Hrs.)** General chemical behaviour of aromatic heterocycles classification (structural type) criteria of aromaticity(bond length ring current and chemical shift in H NMR- Spectra empirical resonance energy, delocalization energy and Dewar resonance energy Diamagnetic susceptibility exaltations) **Non- aromatic Heterocycles** **(6 Hrs.)** Strain-bond angle and torsional strains and their conseqences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular Geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Stereo-electronic effects- anomeric and related effects Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions. **UNIT 2**
					IVth	**Aromatic Heterocycles** General chemical behaviour of aromatic heterocycles classification (structural type) criteria of aromaticity (bond length ring current and	

						chemical shift in 1HNMR- Spectra, Empirical resonance energy**,** Delocalization energy	**Heterocyclic synthesis (5 Hrs.)** Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition Reactions. **Small Ring Heterocycles (5 Hrs.)** Three- membered and four-membered heterocycles-synthesis and reactions of aziridines , oxiranes, thiiranes, azetidines, oxetanes and thietanes **Benzo-Fused Five-Memberd Heterocycles (5 Hrs.)** Synthesis and reaction including medicinal applications of benzopyrroles, benzofurans and benzothiophenes **UNIT 3 (5 Hrs.)** **Meso-ionic Heterocycles** General classification chemistry of some important meso-ionic heterocycles of type-A and B and their applications **Synthesis of pharmaceutical compounds having heterocyclic ring with one or more heteroatom.** Pencillin-V, Cephalosporin –C, Benzodiazepine (Midazolam, Diazepam), (Antidepressant Fluoxetine, Escitalopram), Proton Pump inhibitors (Omeprazole, Pentoperazole), Antihypertensive (Nifedipine, Losartan) **Six-Membered Heterocycles with Two or More Hetroatoms (5 Hrs.)** Synthesis and reactions of diazines, triazines, tetrazines and thiazines **UNIT 4** **1,2-Azoles: pyrazoles, isothiazoles and isoxazoles (7 Hrs.)** Introduction to 1,2-azoles, synthesis of 1,2-azoles. Addition on nitrogen: protonation, N-alkylation, N-acylation. Reaction with electrophilic and nucleophilic reagents. Reaction with bases: reaction of N-metallated pyrazole, reaction of C-metallated 1,2-azoles. Reaction with oxidizing and redusing
					V^{th}	Dewar resonance energy Diamagnetic susceptibility exaltations) **Non-aromatic Heterocycles** Strain-bond angle and torsional strains	
				August	II^{nd}	Conseqences in small ring heterocycles, Conformation of six-membered heterocycles with reference to molecular Geometry	
					IIIrd	Barrier to ring inversion, Pyramidal inversion	
					IV^{th}	1,3-diaxial interaction. Stereo-electronic effects- anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions.	

					Vth	**UNIT 2 Heterocyclic synthesis** Principles of heterocyclic synthesis involving cyclization reactions Cycloaddition Reactions. **Small Ring Heterocycles** Three-membered and four-membered heterocycles-synthesis	agents. **1,3-Azoles: imidazoles, thiazoles and oxazoles (8 Hrs.)** Introduction to 1,3-azoles, synthesis of 1,3-azoles. Addition at nitrogen: protonation, N-alkylation, N-acylation. Reaction with electrophilic and nucleophilic reagents.Reaction with bases: reaction of N-metallated imidazole, reaction of C-metallated 1,3-azoles.Reaction with oxidizing and reducing agents. Synthesis and reaction of quaternary 1,3-azolium salt and 1,3-azole-N-oxide.
				September	Ist	Reactions of aziridines ,oxiranes, thiiranes, Azetidines, oxetanes and thietanes **Benzo-Fused Five-Memberd Heterocycles** Synthesis and reactions of benzopyrroles, benzofurans	
					IInd	Synthesis and reactions of benzothiophenes, Medicinal applications of benzopyrroles, benzofurans and benzothiophenes	
					IIIrd	**UNIT 3 Meso-ionic Heterocycles** General classification chemistry of some	

						important meso-ionic heterocycles of type-A and B and their applications	
					IVth	**Synthesis of pharmaceutical compounds having heterocyclic ring with one or more heteroatom.** Pencillin-V, Cephalosporin–C, Benzodiazepine (Midazolam, Diazepam),, (Antidepressant Fluoxetine, Escitalopram)	
				October	Ist	Proton Pump inhibitors (Omeprazole, Pentoperazole), Antihypertensive (Nifedipine, Losartan) **Six-Membered Heterocycles with Two or More Hetroatoms** Synthesis and reactions of diazines, triazines, tetrazines and thiazines	

					II[nd]	**UNIT 4** **1,2-Azoles: pyrazoles, isothiazoles and isoxazoles** Introduction to 1,2-azoles, synthesis of 1,2-azoles. Addition on nitrogen: protonation, N-alkylation, N-acylation.	
					III[rd]	Reaction with electrophilic and nucleophilic reagents. Reaction with bases: reaction of N-metallated pyrazole,	
					IV[th]	Reaction of C-metallated 1,2-azoles. Reaction with oxidizing and redusing agents. **1,3-Azoles: imidazoles, thiazoles and oxazoles** Introduction to 1,3-azoles, synthesis of 1,3-azoles. Addition at nitrogen: protonation, N-alkylation,	
					V[th]	N-acylation. Reaction with electrophilic and nucleophilic	

						reagents.Reaction with bases: reaction of N-metallated imidazole,	
				November	Ist	Reaction of C-metallated 1,3-azoles.Reaction with oxidizing and reducing agents.	
					IInd	Synthesis and reaction of quaternary 1,3-azolium salt and 1,3-azole-N-oxide.	
5.	Dr. Gurpreet Kaur	M.Sc-II	CH-511 Applications of Spectroscopy-I	July	IIIrd	**UNIT 3** **Infrared Spectroscopy** Instrumentation and sample handling. Characteristics vibrational frequencies of alkanes, alkenes	**UNIT 3 (5 Hrs.)** **Infrared Spectroscopy** Instrumentation and sample handling. Characteristics vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers Phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones,lactans and conjugated carbonyl compounds). Effect of hydrogrn bonding, solvent effect on vibrational frequencies , overtones, combination bands and Fermi resonance. FT-IR of gaseous, solid and polymeric materials. **Nuclear Magnetic Resonance Spectroscopy (10 Hrs.)** General introduction and definition, chemical shift, spin spin interaction,shielding mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic,olefinic,aldehydic and aromatic) another nuclei (alcoholic, phenols, enols, carboxylic acids, amines, amides & mercapto),chemical exchange,effect of deuteration,complex spin-spin interaction between two, three, four, five nuclei (first order sperctra) virtual coupling, stereochemistry,
					IVth	Alkynes, aromatic compounds, alcohols ,ethetrs, Phenols and amines .	
					Vth	Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides	
				August	Ist	Acids, anhydrides, lactones,lactans and conjugated carbonyl compounds). Effect of	

						hydrogrn bonding	hindered rotation, karplus curve variation of coupling constant with dihedral angle. simplification of complex spectra- nuclear magnetic double resonance, contact shift reagents, solvent effects,fourier tansform technique, nuclear overhauser effect (NOE) resonance of other nuclei –F,P **UNIT 4 (6 Hrs.)** **Carbon-13 NMR spectroscopy** General consideration chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon)coupling constants. Two dimension NMR spect-roscopy –COSY,NOESY, DEPT,APT, and INADEQUATE technique. **Mass Spectrometry (**Introduction, ion production –EI,CI,FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectra fragmentation of organic compounds, common functional group, molecular ion peak, metastable peak, Mclafferty rearrangement. nitrogen rule, high resolution mass spectrometery. Example of mass spectral fragmentation of organic compounds with respect to their structure determination.
					IInd	Solvent effect on vibrational frequencies ,overtones,combination bands and Fermi resonance.	
					IIIrd	FT-IR of gaseous, solid and polymeric materials. **Nuclear Magnetic Resonance Spectroscopy** General	

						introduction and definition, chemical shift	
					IVth	Spin spin interaction,shielding mechanism of measurement, chemical shift values and correlation for protons bonded to carbon	
					Vth	(aliphatic,olefinic,aldehydic and aromatic) another nuclei (alcoholic, phenols,	
				September	Ist	Enols, carboxylic acids, amines, amides & mercapto),chemical exchange,effect of deuteration,	
					IInd	Complex spin-spin interaction between two, three, four, five nuclei (first order sperctra) virtual coupling, stereochemistry,	
					IIIrd	Hindered rotation, karplus curve variation of coupling constant with dihedral angle. simplification of complex spectra-	

						nuclear magnetic double reasonane	
					IVth	Contact shift reagents, solvent effects,fourier tansform tecnhnique, nuclear overhauser effect (NOE) resonance of other nuclei –F,P	
				October	Ist	**UNIT 4** **Carbon-13 NMR spectroscopy** General considration chemical shift (aliphatic, olefinic Alkyne, aromatic, heteroaromatic and carbonyl carbon)	
					IInd	Coupling constants, Two dimension NMR spect- roscopy – COSY,NOESY	
					IIIrd	DEPT, APT, and INADEQUATE technique. **Mass Spectrometry (**Introduction, ion production –EI,CI	
					IVth	FD and FAB, factors affecting fragmentation,ion analysis,ion	

						abundance.	
				November	Ist	Mass septra fragmentation of organic compounds,common functional group,molecular ion peak,metastabl peak,	
					IInd	Mclafferty rearrangement. nitrogen rule, high resolution mass spectrometery. Example of mass spectral fragmentation of organic compounds with respect to their structure determination.	
7.	Dr. Shivali Sharma	M.Sc-II	CH-511 Applications of spectroscopy-I	July	IIIrd	**UNIT 1** **Electron Spin Resonance Spectroscopy** Hyperfine coupling, spin polarization for atoms and transition metal ions, spin orbit coupling,	**UNIT 1 (8 Hrs.)** **Electron Spin Resonance Spectroscopy** Hyperfine coupling, spin polarization for atoms and transition metal ions, spin orbit coupling and significance of g-tensors , application of transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as $OH^{\cdot -}$,$SO_4^{-\cdot}$,$H_2PO_4^{-\cdot}$,$PO_4^{2-\cdot}$,$HPO_4^{-\cdot}$ **Nuclear Magnetic Resonence of Paramagnetic Substances**

					IVth	Significance of g-tensors, Application of transition metal complexes (having one unpaired electron) biological systems	**in Solution (7Hrs.)** The contact and pseudo contact shifts , factors affecting nuclear relaxation, some applications including biochemical systems , an overview of NMR of metal nuclides with emphasis on ^{195}Pt and ^{119}Sn NMR. **UNIT 2** **Mossbauer Spectroscopy (6 Hrs.)** Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin , (2) Sn^{+2} and Sn^{+4} compounds- nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms. **Vibrational Spectroscopy (5 Hrs.)** Mode of bonding of ambidentate ligands, ethylenediamine and diketonato complexes, applications of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins. **Ultraviolet and Visible Spectroscopy (4 Hrs.)** Various electronic transitions (185-800nm),Beer-Lambert law, effect of solvent on electronic transition, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser- Woodwared rules for conjugated dienes and carbonyl , ultraviolet spectra of aromatic and heterocyclic compounds. Steric effect in biphenyles.
					Vth	To inorganic free radicals such as $OH^{\cdot -}$,$SO_4^{-\cdot}$,$H_2PO_4^{-\cdot}$,$PO_4^{2-\cdot}$,$HPO_4^{-\cdot}$	
				August	Ist	**Nuclear Magnetic Resonence of Paramagnetic Substances in Solution** The contact and pseudo contact shifts Factors affecting nuclear relaxation Some applications including biochemical systems ,	
					IInd	An overview of NMR of metal nuclides, ^{195}Pt and ^{119}Sn NMR.	
					IIIrd	**UNIT 2** **Mossbauer Spectroscopy** Basic principles, spectral parameters and	

						spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin	
					IVth	(2) Sn^{+2} and Sn^{+4} compounds- nature of M-L bond, coordination number, structure and	
					Vth	(3) Detection of oxidation state and inequivalent MB atoms **Vibrational Spectroscopy** Mode of bonding of ambidentate ligands, ethylenediamine and diketonato complexes,	
				September	Ist	Applications of resonance Raman spectroscopy Particularly for the study of active sites of metalloproteins.	

					II[nd]	**Ultraviolet and Visible Spectroscopy (4 Hrs.)** Various electronic transitions (185-800nm),Beer-Lambert law,	
					III[rd]	Effect of solvent on electronic transition, ultraviolet bands for carbonyl compounds,	
					IV[th]	Unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser-Woodwared rules for conjugated dienes	
				October	I[st]	Conjugated polyenes. Fieser- Woodwared rules for conjugated dienes	
					II[nd]	Fieser- Woodwared rules for carbonyl compounds	
					III[rd]	Ultraviolet spectra of aromatic and heterocyclic compounds.	
					IV[th]	Steric effect in biphenyles.	

9.	Dr. Shivali Sharma	M.Sc-II	CH-512 Organotransition Metal Chemistry-II	July	III[rd]	**UNIT 1 Compounds of Transition Metal-Carbon Multiple Bonds** Alkylidenes, alkylidynes, low valent Carbenes and carbynes-	**UNIT 1 (12 Hrs.)** **Compounds of Transition Metal-Carbon Multiple Bonds** Alkylidenes, alkylidynes, low valent Carbenes and carbynes- Synthesis, nature of bond, Structural Characteristics, nucleophilic and Electrophilic reaction on the ligands, role in organic synthesis **Transition Metal Compounds with Bonds to Hydrogen (3 Hrs.)** Transition metal Compounds with bonds to hydrogen **UNIT 2** **Transition Metal Complexes (15 Hrs.)** Transition Metal Complexes with unsaturated Organic molecules, alkenes, alkynes, Allyl, diene, dienyl, arene and trienyl complexes, preparations, properties, nature of bonding and structural features important reactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis. **UNIT 3** **Alkyls and Aryls of Transition Metals (6 Hrs.)** Types, routes of synthesis, Stability and decomposition Pathways, organocopper in Organic Synthesis. **Fluxional organometallic compounds (9 Hrs.)** Fluxionality and dynamic equilibria in compounds such as η2 Allyl and dienyl Complexes. **UNIT 4 (15 Hrs.)** **Homogeneous Catalysis** Stoichiometric reaction for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reations involving carbon monoxide such as hydrocarbonylation of olefins (oxo reaction) oxopalladation reactions, activation of C-H bond. Monsanto acetic acid synthesis, water gas shift reaction and Fischer–Tropsch
					IV[th]	Synthesis, nature of bond, Structural Characteristics, nucleophilic and Electrophilic reaction on the ligands	
					V[th]	Role in organic synthesis **Transition Metal Compounds with Bonds to Hydrogen** Transition metal Compounds with bonds to hydrogen	

							Synthesis**.**
				August	Ist	**UNIT 2** **Transition Metal Complexes** Transition Metal Complexes with unsaturated Organic molecules, preparations, properties, nature of bonding and structural features important reactions relating to nucleophilic and electrophilic attack on ligands of alkenes, alkynes	
					IInd	Preparations, properties, nature of bonding and structural features important reactions relating to nucleophilic and electrophilic attack on ligands of Allyl, diene, dienyl	
					IIIrd	Preparations, properties, nature of bonding and structural features important	

						reactions relating to nucleophilic and electrophilic attack on ligands of arene and trienyl complexes	
					IVth	To organic synthesis. **UNIT 3** **Alkyls and Aryls of Transition Metals** Types, routes of synthesis,	
					Vth	Stability and decomposition Pathways, organocopper in Organic Synthesis.	
				September	Ist	**Fluxional organometallic compounds** Fluxionality and dynamic equilibria in compounds such as η2 Allyl	
					IInd	Dienyl Complexes.	
					IIIrd	**UNIT 4** Stoichiometric reaction for catalysis, homogeneous catalytic	

						hydrogenation, Zeigler-Natta polymerization of olefins,	
					IVth	Catalytic reations involving carbon monoxide such as hydrocarbonylation of olefins (oxo reaction)	
				October	Ist	Oxopalladation reactions,	
					IInd	Activation of C-H bond.	
					IIIrd	Monsanto acetic acid synthesis, water gas shift reaction	
					IVth	Fischer–Tropsch Synthesis**.**	

End Semester	**02-12-19**	**To**	**21-12-19**	**(18 days)**
Examinations	**Monday**		**Saturday**	
Semester Vacation	**22-12-19**	**To**	**02-01-19**	**(12days)**
(Winter Break)	**Sunday**		**Tuesday**	