GUJRANWALA GURU NANAK KHALSA COLLEGE, CIVIL LINES, LUDHIANA

AFFILIATED TO PANJAB UNIVERSITY, CHANDIGARH

Academic Calendar for the session 2018-19 with Under Graduate & Post Graduate Chemistry Course having Semester System of examination:-

SummerVacation	**02-06-18** **Saturday**	**To**	**08-07-18** **Sunday**	**(39 days)**

Academic Calendar

Colleges Open on and normal Admission for on-going Classes	**09-07-18** **Monday**			

Admission Shedule

Admission Process		**upto**	**13-07-18** **Friday**	**(07 days)**
Normal Admission for New classes (except for those Classes in which admission is Through PU-CET(U.G.))	**16-07-18** **Monday**	**To**	**28-07-18** **Saturday**	**(13 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.	**30-07-18 Monday**	**To**	**13-08-18 Monday**	**(15 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	**14-08-18 Tuesday**	**To**	**31-08-18 Friday**	**(18 days)**

Academic Term –I (b) **09-07-18** **To** **07-12-18** **(97 teaching days)**

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

Total teaching days of Academic Term I = 97 Days

Bachelor of Sciences Session 2018-2019 (First Semester)							
S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Prof. Vishal	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, curve sketching, linear graphs 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	
					IInd	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	
					IIIrd	**UNIT-III Stereochemistry of Organic Compounds I:** Concept of isomerism, Types of isomerism. Optical isomerism – Elements of symmetry, molecular chirality, enantiomers, stereogeniccenter,	
					IVth	Optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccenters, diastereomers, threo and erythrodiastereomers, meso compounds,	
					Vth	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. Jyoti	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,	
					Vth	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	IInd	Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O+, SF_4, ClF_3, ICl^-_2 and H_2O.	
					IIIrd	MO theory	
					IVth	Homonuclear (elements and ions of 1st and 2nd row),	
					Vth	Heteronuclear (BO, CN, CO^+, NO^+, CO, CN^-)	
				November	Ist	Diatomic molecules. Percentage ionic character from dipole moment and electronegativity difference.	

Bachelor of Sciences Session 2018-19 Third Semester

S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Prof. Vishal	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	
					IIIrd	Carnot theorem. Thermodynamic scale of temperature. *Concept of Entropy:* Entropy as a state function	
					IVth	Entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change	
					Vth	Clausius inequality, entropy as a criteria of spontaneity and equilibrium.	
				October	IInd	Entropy change in ideal gases and mixing of gases.	
					IIIrd	**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	
					Vth	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).	
					IInd	Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effects of heat and hydrating agents.	
3.	Prof. Amanpreet Kaur	B.Sc.-II	Paper-IX Inorganic Chemistry-A	July	IIIrd	**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.
					IVth	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	Ist	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 2018-2019 (Fifth Semester)							
S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Prof.Jyoti	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	

					Vth	Factors affecting the substitution reactions of square planar complexes	
				September	IInd	UNIT-III **Organometallic Chemistry**: Definition, nomenclature and classification of organometallic compounds.	
					IIIrd	Preparation, properties, bonding and applications of alkyls and aryls of Li, Al	
					IVth	Preparation, properties, bonding and applications of alkyls and aryls of Hg, Sn and Ti,	
					Vth	A brief account of metal – ethylenic complexes and homogeneous hydrogenation,	
				October	IInd	Mononuclear carbonyls and the nature of bonding in metal carbonyls	
					IIIrd	UNIT-IV **Bioinorganic Chemistry**: Essential and trace elements in biological processes	

					IVth	Metalloporphyrins with special reference to haemoglobin and myoglobin.	
					Vth	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
					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	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.
					IInd	Intensity and position of IR bands, measurement of IR spectrum, fingerprint region,	
					IIIrd	Characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds	
					IVth	Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.	
					Vth	UNIT-IV **Carbohydrates**: Classification and nomenclature. Monosaccharides	
				October	IInd	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	
					IV[th]	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	I[st]	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.	
					II[nd]	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	III[rd]	**UNIT-I Elementary Quantum Mechanics-I**:	**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

						Black-body radiation, Planck's radiation law, photoelectric effect,	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**: 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.
					IVth	Heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. De Broglie hypothesis,	
				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.	
					IIIrd	**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).	
					Vth	Photochemistry of carbonyl compounds and alkenes.	

Master of Sciences			Session 2018-2019				(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	**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. **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 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.
					II^{nd}	Energetics of hybridization, some simple reactions of covalently bonded molecules	
					III^{rd}	**UNIT 2 Metal Ligand Bonding** Limitations of crystal field theory,	
					IV^{th}	Molecular orbital theory, octahedral,	
					V^{th}	Tetrahedral**,** Square planar complexes,	

				September	Ist	π bonding and molecular orbital theory.	
					IInd	**Unit IV** **Reaction Mechanism of Transition Metal Complexes –II** Acid hydrolysis,	
					IIIrd	Factors affecting acid hydrolysis,	
					IVth	Base hydrolysis, conjugate base mechanism,	
				October	Ist	Reactions without metal-ligand bond cleavage	
					IInd	Substitution reactions in square planar complexes,	
					IIIrd	The trans effect, mechanism of substitution reaction Redox reactions,	
					IVth	Electron transfer reactions, mechanism of one electron transfer reactions	
					Vth	Outer sphere type reactions, cross reactions	
				November	Ist	Marcus Hush Theory	
					IInd	Inner sphere type reactions.	

2.	Prof Jyoti	M.Sc-I	CH-411 Inorganic Chemistry-I	August	Ist	**UNIT 3** **Metal-Ligand Equilibria In Solution** Stepwise and overall formation constant	**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.
					IInd	Interaction trends in stepwise constants	
					IIIrd	Factors affecting the stability of metal complexes	
					IVth	Reference to the nature of metal ion and ligand	
					Vth	Chelate effect	
				September	Ist	Thermodynamic origin of chelate efffect	
					IInd	Determination of binary formation constants	
					IIIrd	Using pH spectrophotometry.	
					IVth	**Reaction Mechanism of Transition Metal Complexes-I** Energy profile of a reaction	
				October	Ist	Reactivity of metal complexes	
					IInd	Inert and labile complexes	

					III[rd]	Kinetic application of valance bond theory	
					IV[th]	Kinetic application of crystal field theories	
				November	I[st]	Kinetics of octahedral substitution.	
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.)** **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**
					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	
					IV[th]	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.	The SN2, SN1, mixed SN1 and SN2 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. **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** 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.
				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.	
					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	
					IIIrd	Phase transfer catalysis, ambident nucleophile, regioselectivity. **UNIT 4** **Aromatic Electrophilic Substitution** The arenium ion mechanism, orientation and reactivity, energy profile	

						diagrams	
					IVth	The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles.	
				November	Ist	$S_{RN}1$ mechanisms, Reactivity-effect of substrate structure, leaving group and attacking nucleophile	
					IInd	The Von Richter, Sommelet-Hauser and smiles rearrangements.	
4.	Prof. Vishal	M.Sc-I	CH-413 Physical Chmistry-I	August	Ist	**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 :**
					IInd	Approximate Methods: The variation theorem, Linear variation Principle, perturbation theory (first order, second order and Non degenerate),	
					IIIrd	Applications of variation method and perturbation theory to the Helium atom. Self-Consistent-Field	

						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:** 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**.**
					IVth	**UNIT 2** **Angular Momentum:** Ordinary ang. momentum, generalized angular momentum, eigen functions for angular momentum, eigen values of angular momentum,	
				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)	
					V^{th}	Partition functions: Translational, Rotational, Vibrational, Electronic partitions functions. Calculation of Thermodynamic properties in terms of partition functions.	
				November	I^{st}	Heat capacity, behavior of solids chemical equilibria and equilibrium constant in terms of partition function, F.D. statistics,	
					II^{nd}	Distribution law and application to metals. Bose Einsteins statistics. Distribution law & application to Helium**.**	

Master of Sciences			Session 2018-2019				(Third Semester)
S.No.	**Teacher**	**Class**	**Paper**	**Month**	**Week**		**Syllabus**
1.	Dr. Geeta Jallan	M.Sc-II	CH-514 Environmental Chemistry-IV	July	III[rd]	**UNIT 1 Environment** Introduction.composition of atmosphere	**UNIT 1 (6 Hrs)** **Environment** Introduction. Ccomposition 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
					IV[th]	Vertical temperature, heat budget of the Earth atmospheric system.	
					V[th]	vertical stability atmosphere.	
				August	I[st]	Biogeochemical cycles of C,N,P,S and O. Biodistribution of elements.	
					II[nd]	**Environmental Toxicology** Chemical solutions to environmental problems, biodegradability,	
					III[rd]	Principles of decomposition,better industrial processes.	

					IVth	Bhopal gas tragedy, Chernobyl,	
				September	Ist	Three mile island, Sewozo	
					IInd	**UNIT 2** **Industrial Pollution** Cement sugar, distillery, drug, paper,	
					IIIrd	thermal power plants, nuclear Power plants, metallurgy	
					IVth	Polymers, drugsetc. Radionuclide analysis	
				October	Ist	Disposal of wastes and their management	
					IInd	Minamata disasters	

					III[rd]	Composition, micro and macro nutrients	
					IV[th]	Pollution-fertilizers, pesticides	
					V[th]	Plastic and metals. Waste treatment	
2.	Dr. Arvinder Kaur	M.Sc-II	CH-514 Environmental Chemistry-IV	July	III[rd]	**UNIT 3** **Hydrosphere** Chemical composition of water bodies-lakes, streams	**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, 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 redicals and their formation. Chemical and photochemical reactions in
					IV[th]	Rivers and wet lands etc. Hydrological cycle.	
				August	I[st]	Aquatic pollution – inorganic, organic, pesticide, agricultural	
					II[nd]	Industrial and Sewage, detergents, oil spills and oil pollutants.	

					III[rd]	Water Quality parameters –Dissolved oxygen, biochemical oxygen demand	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.
					IV[th]	Solids, metals, content of Chloride, sulphate, phosphate	
					V[th]	Nitrate and micro-organisms. Water quality Standards.	
				September	I[st]	Analytical methods for measuring BOD, DO, COD, F,	
					II[nd]	metals (As,Cd,Cr, Hg,Pb,Se etc.), residual chloride and chlorine demand	
					III[rd]	Purification and treatment of water.	
					IV[th]	**UNIT 4** **Atmosphere** Chemical composition of atmosphere	
				October	I[st]	Particles, ions and redicals and their formation	

					II[nd]	Chemical and photochemical reactions in atmosphere	
					III[rd]	Smog formation, oxides of Chlorofluorohydrocarbons	
					IV[th]	Ozone depletion, Global warming. Green house effect	
				November	I[st]	Acid rain, air pollution controls and their chemistry.	
					II[nd]	Analytical methods for measuring air pollutants. Continuous monitoring instruments.	
3.	Dr. Arwinder Kaur	M.Sc-II	CH-513 Heterocyclic Chemistry-II	July	III[rd]	**UNIT 1** **Nomenclature of Heterocycles** Replacement and systematic nomenclature (Hantzsch-widman System)	**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)
					IV[th]	Monocyclic fused and bridged hetrocycles	

					Vth	**Aromatic Heterocycles** General chemical behaviour of aromatic heterocycles classification (structural type) criteria of aromaticity	**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 nucleophilicelectrophilic interactions. **UNIT 2** **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
				August	IInd	(bond length ring current and chemical shift in 1HNMR-Spectra, empirical resonance energy	
					IIIrd	Delocalization energy and Dewar resonance energy Diamagnetic susceptibility exaltations)	
					IVth	**Non-aromatic Heterocycles** Strain-bond angle and torsional strains	
					Vth	Conseqences in small ring heterocycles	
				September	Ist	Conformation of six-membered heterocycles with reference to molecular Geometry, barrier to ring inversion,	

					II[nd]	Pyramidal inversion and 1,3-diaxial interaction. Stereo-electronic effects-anomeric and related effects	
					III[rd]	Attractive interactions-hydrogen bonding and intermolecular nucleophilicelectrophilic interactions.	
					IV[th]	**UNIT 2** **Heterocyclic synthesis** Principles of heterocyclic synthesis involving cyclization reactions	
				October	I[st]	Cycloaddition Reactions. **Small Ring Heterocycles** Three-membered and four-membered heterocycles-synthesis	
					II[nd]	Reactions of aziridines , oxiranes, thiiranes	
					III[rd]	Azetidines, oxetanes and thietanes	

					IVth	**Benzo-Fused Five-Memberd Heterocycles** Synthesis and reactions of benzopyrroles, benzofurans	
					Vth	Synthesis and reactions of benzothiophenes	
				November	Ist	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 **Six-Membered Heterocycles With (5 Hrs.)** One Heteroatom Synthesis and reactions of pyrylium salt and pyrones and their comparison with Pyridinium & thiopyrylium salt and Pyridones synthesis and reactions of Quinolizinium and benzopyrylium salt coumarins and chromones **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 agents.
4.	Dr. Rish Jain	M.Sc-II	CH-513 Heterocyclic Chemistry-II	July	IIIrd	**UNIT 3** **Meso-ionic Heterocycles** General classification chemistry of some important meso-ionic heterocycles	
					IVth	Type-A and B and their applications	
				August	Ist	**Six-Membered Heterocycles With** One Heteroatom Synthesis and reactions of pyrylium salt	

					IInd	Pyrones and their comparison with Pyridinium & thiopyrylium salt and Pyridones synthesis and reactions of Quinolizinium	**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.
					IIIrd	Benzopyrylium salt coumarins and chromones **Six-Membered Heterocycles with Two or More Hetroatoms** Synthesis of diazines, triazines	
					IVth	Synthesis of tetrazines and thiazines, reactions of diazines, triazines	
					Vth	Reactions of tetrazines and thiazines, **UNIT 4 1,2-Azoles: pyrazoles, isothiazoles and isoxazoles** Introduction to 1,2-azoles, synthesis of 1,2-azoles. Addition on nitrogen	

				September	Ist	Protonation, N-alkylation, N-acylation. Reaction with electrophilic and nucleophilic reagents.	
					IInd	Reaction with bases: reaction of N-metallated pyrazole, reaction of C-metallated 1,2-azoles	
					IIIrd	Reaction with oxidizing and redusing agents.	
					IVth	**1,3-Azoles: imidazoles, thiazoles and oxazoles** Introduction to 1,3-azoles, synthesis of 1,3-azoles. Addition at nitrogen: protonation	
				October	Ist	N-alkylation, N-acylation. Reaction with electrophilic and nucleophilic reagents	
					IInd	Reaction with bases: reaction of N-metallated imidazole, reaction of C-metallated 1,3-azoles	

					III[rd]	Reaction with oxidizing and reducing agents.	
					IV[th]	Synthesis and reaction of quaternary 1,3-azolium salt	
				November	II[nd]	Synthesis and reaction of 1,3-azole-N-oxide.	
5.	Dr. Gurpreet Kaur	M.Sc-II	CH-511 Applications of Spectroscopy-I	July	III[rd]	**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, ethetrs 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, hindered rotation, karplus curve variation of coupling
					IV[th]	Alkynes, aromatic compounds, alcohols ,ethetrs, Phenols and amines .	
					V[th]	Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides	
				August	I[st]	Acids, anhydrides, lactones,lactans and conjugated carbonyl compounds). Effect of hydrogrn bonding	

							constant with dihedral angle. simplification of complex spectra- nuclear magnetic double reasonane, contact shift reagents, solvent effects,fourier tansform tecnhnique, nuclear overhauser effect (NOE) resonance of other nuclei –F,P **UNIT 4 (6 Hrs.)** **Carbon-13 NMR spectroscopy** General considration 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 septra 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,	
					II[nd]	Complex spin-spin interaction between two, three, four, five nuclei (first order sperctra) virtual coupling, stereochemistry,	
					III[rd]	Hindered rotation, karplus curve variation of coupling constant with dihedral angle. simplification of complex spectra-nuclear magnetic double reasonane	
					IV[th]	Contact shift reagents, solvent effects,fourier tansform tecnhnique, nuclear overhauser effect (NOE) resonance of other nuclei –F,P	
				October	I[st]	**UNIT 4** **Carbon-13 NMR spectroscopy** General considration chemical shift (aliphatic, olefinic Alkyne, aromatic, heteroaromatic and	

						carbonyl carbon)	
					II[nd]	Coupling constants, Two dimension NMR spect- roscopy – COSY,NOESY	
					III[rd]	DEPT, APT, and INADEQUATE technique. **Mass Spectrometry** **(**Introduction, ion production –EI,CI	
					IV[th]	FD and FAB, factors affecting fragmentation,ion analysis,ion abundance.	
				November	I[st]	Mass septra fragmentation of organic compounds,common functional group,molecular ion peak,metastabl peak,	
					II[nd]	Mclafferty rearrangement. nitrogen rule, high resolution mass spectrometery. Example of mass	

						spectral fragmentation of organic compounds with respect to their structure determination.	
6.	Prof. Vishal	M.Sc.-II	CH-511 Applications of Spectroscopy-I	July	IIIrd	**Ultraviolet and Visible Spectroscopy** Various electronic transitions (185-800nm),Beer-Lambert law,	**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.
					IVth	effect of solvent on electronic transition, ultraviolet bands for carbonyl compounds,	
				August	Ist	Unsaturated carbonyl compounds, dienes, conjugated polyenes	
					IInd	Fieser- Woodwared rules for conjugated dienes and carbonyl	
					IIIrd	Ultraviolet spectra of aromatic and heterocyclic compounds	
					IVth	Steric effect in biphenyles.	

7.	Dr. Shivali Sharma	M.Sc-II	CH-511 Applications of spectroscopy-I	September	Ist	**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 PH_4 , F_2 AND $[BH_3]^-$ **Nuclear Magnetic Resonence of Paramagnetic Substances 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.)** Symmetrey and shapes of AB_2 ,AB_3,AB_4, AB_5 and AB_6 .Mode of bonding of ambidentate ligands, ethylenediamine and diketonato complexes, applications of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins.
					IInd	Significance of g-tensors , application of transition metal complexes (having one unpaired electron)	
					IIIrd	biological systems and to inorganic free radicals such as PH_4 , F_2 AND $[BH_3]^-$	
					IVth	**Nuclear Magnetic Resonence of Paramagnetic Substances in Solution** The contact and pseudo contact shifts , factors affecting nuclear relaxation	
				October	Ist	Some applications including biochemical systems , an overview of NMR of metal nuclides	

					II[nd]	^{195}Pt and ^{119}Sn NMR. **UNIT 2** **Mossbauer Spectroscopy** Basic principles, spectral parameters and spectrum display.	
					III[rd]	Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin	
					IV[th]	(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	
					V[th]	**Vibrational Spectroscopy** Symmetrey and shapes of AB_2 ,AB_3,AB_4, AB_5 and AB_6	
				November	I[st]	Mode of bonding of ambidentate ligands, ethylenediamine and	

						diketonato complexes,	
					IInd	Applications of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins.	
8.	Prof Amanpreet Kaur	M.Sc-II	CH-512 Organotransition Metal Chemistry-II	July	IIIrd	**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 **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.
					IVth	Synthesis, nature of bond, Structural Characteristics,	
					Vth	Nucleophilic and Electrophilic reaction on the ligands	
				August	Ist	**UNIT 4 Homogeneous Catalysis** Stoichiometric reaction for catalysis,	

						homogeneous catalytic hydrogenation,	
					II[nd]	Zeigler-Natta polymerization of olefins, catalytic reations involving carbon monoxide	
					III[rd]	Hydrocarbonylation of olefins (oxo reaction) oxopalladation reactions,	
					IV[th]	activation of C-H bond.	
9.	Dr.Shivali Sharma	M.Sc-II	CH-512 Organotransition Metal Chemistry-II	September	I[st]	**UNIT 1** **Transition Metal Compounds with Bonds to Hydrogen** Transition metal Compounds with bonds to hydrogen	**UNIT 1** **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
					II[nd]	**UNIT 2** **Transition Metal Complexes** Transition Metal Complexes with unsaturated Organic molecules, preparations, properties, nature of	

						bonding and structural features alkenes, alkynes,	Synthesis. **Fluxional organometallic compounds (9 Hrs.)** Fluxionality and dynamic equilibria in compounds such as η2 olefin, η2 Allyl and dienyl Complexes.
					III[rd]	Preparations, properties, nature of bonding and structural features Allyl, diene, arene	
					IV[th]	preparations, properties, nature of bonding and structural features of trienyl complexes	
				October	I[st]	**UNIT 3** **Alkyls and Aryls of Transition Metals** Types, routes of synthesis,	
					II[nd]	Stability and decomposition Pathways,organocopper in OrganicSynthesis.	
					III[rd]	**Fluxional organometallic compounds** Fluxionality and dynamic equilibria in compounds such as η2 olefin	

					IVth	η2 Allyl	
				November	IInd	Dienyl Complexes	

End Semester Examinations	**08-12-18 Saturday**	**To**	**24-12-18 Monday**	**(13 days)**
Semester Vacation (Winter Break)	**25-12-18 Tuesday**	**To**	**06-01-19 Sunday**	**(13days)**
Academic Term –II				
2nd,4th,6th				
College reopens after Semester Examination	**07-01-19 Monday**	**To**	**09-05-19 Thursday**	**(83 teaching days)**

Total teaching days of Academic Term II= 83 days

Bachelor of Sciences			Session 2018-19		Second Semester		
S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Prof. Vishal	B.Sc.-I	Paper-VII Physical Chemistry-B	January	II[nd]	**UNIT-I Thermodynamics-I:** *Definition of Thermodynamic Terms*: System, surroundings etc. Types of systems, intensive and extensive properties.	**UNIT-I (8 Hrs.)** **Thermodynamics-I:** *Definition of Thermodynamic Terms*: System, surroundings etc. Types of systems, intensive and extensiveproperties. State and path functions and their differentials. Thermodynamic process. Concept of heat andwork.*First Law of Thermodynamics*: Statement, definition of internal energy and enthalpy, Heat capacity, heatcapacities at constant volume and pressure and their relationship. Joule's Law-Joule-Thomson coefficient andinversion temperature. Calculations of w, q, dU&dH for the expansion of ideal gases under isothermal andadiabatic conditions for reversible process. **UNIT-II (7 Hrs.)** ***Thermochemistry:*** Standard state, standard enthalpy of formation-Hess's Law of constant Heat Summation and its applications.Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociationenergy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchoff'sequation. **UNIT- III (7 Hrs.)** **Colloidal State:** Definition of colloids, classification of colloids.*Solids in liquids (sols):* Properties –kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze rules, gold number.*Liquids in liquids (emulsions):* Types of emulsions, preparation. Emulsifier.*Liquids in solids (gels):* Classification, preparation and properties, inhibition, general applications of colloids. **UNIT-IV (8 Hrs.)** **Solutions, Dilute Solutions and Colligative Properties:** Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activitycoefficient.Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weightdetermination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight fromosmotic pressure. Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression of freezing
					III[rd]	State and path functions and their differentials Thermodynamic process. Concept of heat and work. *First Law of Thermodynamics*: Statement, definition of internal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure and their relationship	
					IV[th]	Joule's Law-Joule-Thomson coefficient and inversion temperature. Calculations of w, q,	

						dU&dH for the expansion of ideal gases under isothermal for reversible process	point.Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.
					Vth	Joule's Law-Joule-Thomson coefficient and inversion temperature. Calculations of w, q, dU&dH for the expansion of ideal gases under adiabatic conditions for reversible process.	
				February	IInd	**UNIT-II** ***Thermochemistry:*** Standard state, standard enthalpy of formation-Hess's Law of constant Heat Summation and its applications.	
					IIIrd	Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy	
					IVth	Bond dissociation energy calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchoff's	

						equation.	
					Vth	**UNIT- III** **Colloidal State:** Definition of colloids, classification of colloids. *Solids in liquids (sols):* Properties – kinetic, optical and electrical.	
				March	IInd	Stability of colloids, protective action, Hardy- Schulze rules, gold number.	
					IIIrd	*Liquids in liquids (emulsions) :*Types of emulsions, preparation. Emulsifier	
					IVth	*Liquids in solids (gels):* Classification, preparation and properties, inhibition, general applications of colloids.	
					Vth	**UNIT-IV** **Solutions, Dilute Solutions and Colligative Properties:** Ideal and non-ideal	

						solutions, methods of expressing concentrations of solutions, activity and activity Coefficient.	
				April	Ist	Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination.	
					IInd	Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure	
					IIIrd	Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression of freezing point.	
					IVth	Experimental methods for determining various colligative properties. Abnormal molar	

						mass, degree of dissociation and association of solutes.	
2.	Prof.Ruchika	B.Sc-I	Paper-VI Organic chemistry-B	January	II[nd]	**UNIT-I** **Alkenes, Cycloalkenes**: Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration	**UNIT-I (8 Hrs.)** **Alkenes, Cycloalkenes**: Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff's Rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration – oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene. **UNIT-II (7 Hrs.)** **Dienes and Alkynes :** Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes : Isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization. **UNIT-III (8 Hrs.)** **Arenes and Aromaticity**: Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus and side chain, Structure of benzene, Molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity : The Huckel rule, aromatic ions. Aromatic electrophilic substitution—General pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes, alkynyl benzenes and biphenyl. **UNIT-IV (7 Hrs.)** **Alkyl and Aryl Halides** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Polyhalogencompounds : chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-
					III[rd]	The Saytzeff's Rule, Hofmann elimination, physical properties and relative stabilities of alkenes.Chemical reactions of alkenes – mechanisms involved in hydrogenation, electrophilic and free radicaladditions	
					IV[th]	Markownikoff's rule, hydroboration – oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4.	

				February	I[st]	Polymerization of alkenes. Substitution atthe allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.	elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative relativities of alkyl halides vs. allyl, vinyl and aryl halides.
					II[nd]	**UNIT-II** **Dienes and Alkynes :**Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes: Isolated, conjugated and cumulated dienes.	
					III[rd]	Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1,2 and 1,4 additions, Diels-Alder reaction.	
					IV[th]	Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes	
				March	I[st]	Mechanism of electrophilic and	

						nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.	
					IInd	**UNIT-III** **Arenes and Aromaticity**: Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus and side chain, Structure of benzene : Molecular formula and Kekule structure.	
					IIIrd	Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.Aromaticity : The Huckel rule, aromatic ions.	
					IVth	Aromatic electrophilic substitution— General pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts	

						reaction.Energy profile diagrams	
					Vth	Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes, alkynyl benzenes and biphenyl.	
				April	Ist	**UNIT-IV** **Alkyl and Aryl Halides** Nomenclature and classes of alkyl halides, methods of formation	
					IInd	Chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams.	
					IIIrd	Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions.	

					IVth	The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative relativities of alkyl halides vs. allyl, vinyl and aryl halides.	
3.	Prof.Jyoti	B.Sc.-I	Paper- V Inorganic Chemistry-B	January	IInd	**UNIT-I Chemical Bonding-II** Ionic Solids – Concept of close packing.	**UNIT-I (7 Hrs.)** **Chemical Bonding-II** Ionic Solids – Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurtzite, CaF_2 and antifluorite), radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors. **UNIT-II (8 Hrs.)** **Chemical Bonding-III** Lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond-free electron, valence bond and band theories. Weak Interactions – Hydrogen bonding, Van der Waals forces. **UNIT-III (7 Hrs.)** ***p*-Block Elements-I** Comparative study (including diagonal relationship) of groups 13-14 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-14, hydrides of boron-diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons. **UNIT-IV (8 Hrs.)** ***p*-Block Elements-II** Comparative study of groups 15-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 15-17, silicates (structural principle), tetrasulphurtetranitride, basic properties of halogens, interhalogens and polyhalides.
					IIIrd	Ionic structures, (NaCl type, Zinc blende, Wurtzite, CaF_2 and antifluorite)	
					IVth	Radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors.	
					Vth	**UNIT-II Chemical Bonding-III** Lattice energy and Born-Haber cycle	
				February	IInd	Solvation energy and solubility of ionic solids, polarizing power and polarisability of ions,	
					IIIrd	Fajan's rule. Metallic	

						bond-free electron, valence bond and band theories.	
					IVth	WeakInteractions – Hydrogen bonding, Van der Waals forces.	
					Vth	**UNIT-III** ***p*-Block Elements-I** Comparative study (including diagonal relationship) of groups 13-14 elements compounds like hydrides, oxides, oxyacids	
				March	IInd	Comparative study (including diagonal relationship) of groups 13-14 elements compounds like hydrides, oxides, oxyacids	
					IIIrd	Hydrides of boron-diborane and higher boranes, borazine, borohydrides,	
					IVth	Fullerenes, carbides,	
					Vth	Fluorocarbons	
				April	Ist	**UNIT-IV** ***p*-Block Elements-II** Comparative study of groups 15-17 elements, compounds like hydrides, oxides, oxyacids and halides ofgroups 15-17	
					IInd	Comparative study of	

						groups 15-17 elements, compounds like hydrides, oxides, oxyacids and halides ofgroups 15-17	
					III[rd]	Halides ofgroups 15-17, silicates (structural principle	
					IV[th]	Tetrasulphurtetranitride basic properties of halogens, interhalogens and polyhalides.	

Bachelor of Sciences			**Session 2018-19**				**Fourth Semester**
S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Prof. Vishal	B.Sc.-II	Paper-XV Physical Chemistry-B	January	II[nd]	**UNIT-I (8 Hrs.)** **Phase equilibrium:** Statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule	**UNIT-I (8 Hrs.)** **Phase equilibrium:** Statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system—water, CO_2 and S systems. Phase equilibria of two component system –solid –liquid equilibria, simple eutectic – Bi-Cd system, desiliverisation of lead. Solid solutions—compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaCl-H_2O$) system. Freezing mixtures, acetone-dry ice. Partially Miscible Liquids –Phenol-water, trimethylamine – water, nicotine –water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation, applications. **UNIT-II (7 Hrs.)** **Electrochemistry –I:** Electrical transport –Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch Law, Arrhennius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's
					III[rd]	Phase equilibria of one component system—water, CO2 and S systems.	
					IV[th]	Phase equilibria of two component system –solid –liquid equilibria, simple eutectic – Bi-Cd system, desiliverisation of lead.	

					Vth	Solid solutions—compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaCl-H_2O$) system.	dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. **UNIT-III (8 Hrs.)** **Electrochemistry-II:** Types of reversible electrodes – gas metal – ion, metal –insoluble salt – anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode – reference electrodes – standard electrode potential, sign conventions, electrochemical series and its significance. **UNIT-IV (7 Hrs.)** Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. E.M.F. of a cell and its measurements. Computation of cell E.M.F. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), Polarization, over potential and hydrogen overvoltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.
				February	IInd	Freezing mixtures, acetone-dry ice.	
					IIIrd	Partially Miscible Liquids –Phenol-water, trimethylamine – water, nicotine –water systems.	
					IVth	Lower and upper consolute temperature. Effect of impurity on consolute temperature, immiscible liquids, steam distillation.	
					Vth	Nernst distribution law-thermodynamic derivation, applications	
				March	IInd	**UNIT-II** **Electrochemistry –I:** Electrical transport – Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance,	
					IIIrd	Variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch	

						Law, Arrhennius theory of electrolyte dissociation and its limitations	
					IVth	Weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only).	
					Vth	Transport number, definition and determination by Hittorf method and moving boundary method.	
				April	Ist	**UNIT-III Electrochemistry-II:** Types of reversible electrodes – gas metal – ion, metal –insoluble salt – anion and redox electrodes. Electrode reactions	
					IInd	Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode – reference electrodes – standard electrode potential, sign conventions, electrochemical series and its Significance.	
					IIIrd	**UNIT-IV (7 Hrs.)**	

						Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. E.M.F. of a cell and its measurements. Computation of cell E.M.F.	
					IVth	Calculation of thermodynamic quantities of cell reactions ((ΔG, ΔH and K), Polarization, over potential and hydrogen overvoltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.	
2.	Prof.Ruchika	B.Sc-II	Paper-XIV Organic chemistry-B	January	IInd	**UNIT-I Carboxylic Acid Derivatives:** Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides.	**UNIT-II (7 Hrs.)** **Carboxylic Acid Derivatives:** Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Relative stability & reactivityof acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis(acidic and basic). **UNIT-III (8 Hrs.)** **Ethers , Epoxides Fats, Oils and Detergents:** Nomenclature of ether and methods of their formation, physical properties. Chemical reaction-cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening,reactions of Grignard and organolithium reagents with epoxides. Natural fats, edible and industrial oils of vegetable
					IIIrd	Relative stability & reactivityof acyl derivatives. Physical properties, interconversion of acid	

						derivatives by nucleophilic acyl substitution	origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents; alkyl and aryl sulphonates. **UNIT-IV (7 Hrs.)** **Organic Compounds of Nitrogen:** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Structure and nomenclature of amines, physical properties. Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phasetransfer catalysis. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. **UNIT-IV** **Electromagnetic Spectrum: Absorption Spectra –I: (7 Hrs.)** Ultraviolet (UV) absorption spectroscopy – Absorption laws (Beer – Lambert Law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Woodward Fieser Rules and their applications in calculating maximum values of conjugated alkenes (cyclic as well as acyclic) and conjugated carbonyl compounds.
					IVth	Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis(acidic and basic).	
				February	Ist	**UNIT-II** **Ethers , Epoxides Fats, Oils and Detergents:** Nomenclature of ether and methods of their formation, physical properties. Chemical reaction-cleavage and autoxidation, Ziesel'smethod.	
					IInd	Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.	
					IIIrd	Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils.	
					IVth	Saponification value, iodine value, acid value. Soaps, synthetic	

						detergents; alkyl and aryl sulphonates.	
				March	Ist	**UNIT-III** **Organic Compounds of Nitrogen:** Preparation of nitroalkanes and nitroarenes.	
					IInd	Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.	
					IIIrd	Picric acid. Structure and nomenclature of amines, physical properties. Stereochemistry of amines,	
					IVth	Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phasetransfer catalysis.	
					Vth	Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction.	

				April	I[st]	**UNIT-IV Electromagnetic Spectrum: Absorption Spectra –I:** Ultraviolet (UV) absorption spectroscopy – Absorption laws (Beer – Lambert Law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions	
					II[nd]	Effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.	
					III[rd]	UV spectra of conjugated enes and enones.	
					IV[th]	Woodward Fieser Rules and their applications in calculating maximum values of conjugated alkenes (cyclic as well as acyclic) and conjugated carbonyl compounds.	
3.	Prof.Aman preet Kaur	B.Sc.-II	Paper-XIII Inorganic Chemistry-B	January	II[nd]	**UNIT-I Chemistry of Lanthanide Elements:** Electronic structure, oxidation states	**UNIT-I (8 Hrs.)** **Chemistry of Lanthanide Elements:** Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. **Chemistry of Actinides:** General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from
					III[rd]	Ionic radii and	

						lanthanide contraction	U, similarities between the later actinides and the later lanthanides. **UNIT-II (7 Hrs.)** **Acids and Bases:** Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases. **UNIT-III (8 Hrs.)** **Oxidation and Reduction:** Use of redox potential data – analysis of redox cycle, redox stability in water – Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements. **UNIT-IV (7 Hrs.)** **Non-aqueous Solvents:** Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.
					IVth	Complex formation, occurrence and isolation,	
					Vth	Lanthanide compounds	
				February	IInd	**Chemistry of Actinides:** General features and chemistry of actinides	
					IIIrd	Chemistry of separation of Np, Pu and Am from U,	
					IVth	Similarities between the later actinides and the later lanthanides	
					Vth	**UNIT-II** **Acids and Bases:** Arrhenius, Bronsted-Lowry	
				March	IInd	The Lux-Flood, solvent system	
					IIIrd	Lewis concepts of acids and bases.	
					IVth	**UNIT-III** **Oxidation and Reduction:** Use of redox potential data – analysis of redox cycle	
					Vth	Redox stability in water – Frost, Latimer and Pourbaix diagrams	
				April	Ist	Principles involved in the extraction of the elements	
					IInd	**UNIT-IV** **Non-aqueous Solvents:**	

						Physical properties of a solvent, types of solvents	
					III[rd]	General characteristics of solvent, reactions in non-aqueous solvents with reference to liquid NH_3	
					IV[th]	Reactions in non-aqueous solvents with reference to liquid SO_2.	

Bachelor of Sciences			**Session 2018-2019**				**(Sixth Semester)**
S.No.	Teacher	Class	Paper	Month	Week		Syllabus
1.	Prof.Jyoti	B.Sc.-III	Paper-XXI Inorganic Chemistry-B	January	II[nd]	UNIT-I **Silicones and Phosphazenes**: Silicones	UNIT-I (7 Hrs.) **Silicones and Phosphazenes**: Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes. UNIT-II (8 Hrs.) **Hard and Soft Acids and Bases (HSAB)**: Classification of acids and bases as hard and soft Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness. UNIT-III (8 Hrs.) **Electronic Spectra of Transition Metal Complexes**: Types of electronic transitions, L – S coupling, selection rules for *d-d* transitions, spectroscopic ground states, Orgel – energy level diagram for *d*1 and d^0states, discussion of the electronic spectrum of $[Ti(H2O)_6]^{3+}$ complex ion. UNIT-IV (7 Hrs.) **Magnetic Properties of Transition Metal Complexes**: Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. Correlation of μ_s and μ_{eff}values, orbital contribution to magnetic moments, application of magnetic moment data for 3*d* metal complexes.
					III[rd]	Phosphazenes	
					IV[th]	Nature of bonding in triphosphazenes.	
					V[th]	UNIT-II **Hard and Soft Acids and Bases (HSAB)**: Classification of acids and bases	
				February	II[nd]	Pearson's HSAB concept	
					III[rd]	Acid-base strength and hardness and softness.	

					IVth	Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.	
					Vth	UNIT-III **Electronic Spectra of Transition Metal Complexes**: Types of electronic transitions	
				March	IInd	L – S coupling, selection rules for *d-d* transitions	
					IIIrd	spectroscopic ground states, Orgel – energy level diagram for *d*1 state	
					IVth	Orgel – energy level diagram for d^0 state	
					Vth	Discussion of the electronic spectrum of $[Ti(H2O)_6]^{3+}$ complex ion.	
				April	Ist	UNIT-IV **Magnetic Properties of Transition Metal Complexes**: Types of magnetic behaviour,	
					IInd	Methods of determining magnetic susceptibility, spin-only formula	
					IIIrd	Correlation of μ_s and	

						μ_{eff}values, orbital contribution to magnetic moments,	
					IVth	Application of magnetic moment data for 3*d* metal complexes.	
2.	Prof. Vishal Sharma	B.Sc-III	Paper-XXII Organic chemistry-B	January	IInd	UNIT-I **Amino Acids, Peptides, Proteins and Nucleic Acids**: Classification, structure and stereochemistry of amino acids. Acid-base behavior, isoelectric point and electrophoresis.	UNIT-I (8 Hrs.) **Amino Acids, Peptides, Proteins and Nucleic Acids**: Classification, structure and stereochemistry of amino acids. Acid- base behavior, isoelectric point and electrophoresis. Preparation and reactions of L- amino acids.Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid – phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.Nucleic Acids : Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical Structure of DNA. UNIT-II (7 Hrs.) **Synthetic Polymers**: Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler – Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers. UNIT-III (7 Hrs.) **Organic Synthesis via Enolates**: Acidity of ά-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enoltautomerism of ethyl acetoacetate. Alkylation and acylation of enamines. UNIT-IV (8 Hrs.) **Organometallic Compounds**: Organomagnesium Compounds: The Grignard reagents – Formation, structure and chemical reactions. Organozinc Compounds: Formation and Chemical reactions. Organolithium Compounds: Formation and Chemical reactions.
					IIIrd	Preparation and reactions of L- amino acids	
					IVth	Structure and nomenclature of peptides and proteins. Classification of proteins.	
				February	Ist	Peptide structure determination, end group analysis,	
					IInd	selective hydrolysis of peptides	
					IIIrd	Classical peptide synthesis, solid – phase peptide synthesis. Structures of peptides and proteins	

					IVth	Levels of protein structure. Protein denaturation/renaturation. Nucleic Acids : Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical Structure of DNA.	
				March	Ist	UNIT-II **Synthetic Polymers**: Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization,	
					IInd	Ziegler – Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides,	
					IIIrd	Phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.	
					IVth	Natural and synthetic rubbers. UNIT-III **Organic Synthesis via Enolates**: Acidity of ά-	

						hydrogens,	
					Vth	Alkylation of diethyl malonate and ethyl acetoacetate.	
				April	Ist	Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enoltautomerism of ethyl acetoacetate. Alkylation and acylation of enamines.	
					IInd	UNIT-IV **Organometallic Compounds**: Organomagnesium Compounds: The Grignard reagents – Formation, structure and chemical reactions.	
					IIIrd	Organozinc Compounds: Formation and Chemical reactions.	
					IVth	Organolithium Compounds: Formation and Chemical reactions.	
3.	Dr.Rishu Jain	B.Sc.-III	Paper-XXIII Physical Chemistry-B	January	IInd	UNIT-I **Solid State-I**: Definition of space lattice, unit cell and Miller Indices	UNIT-I (7 Hrs.) **Solid State-I**: Definition of space lattice, unit cell and Miller Indices Laws of Crystallography – (i) Law of Constancy of Interfacial Angles, (ii) Law of Rationality of Indices, (iii) Law of Symmetry. Symmetry elements in crystals.
					IIIrd	Laws of Crystallography – (i) Law of Constancy of	UNIT-II (8 Hrs.) **Solid State-II:** X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal

						Interfacial Angles, (ii) Law of Rationality of Indices, (iii) Law of Symmetry.	structure of NaCl, KCl and CsCl (Laue's method and powder method). Applications of Powder diffraction for structure determination, Thermal and photochemical reaction in solid state UNIT-III (8 Hrs.) **Spectroscopy** : Introduction : Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom. **Rotational Spectrum**: Diatomic molecules. Energy levels of a rigid rotor (semi – classical principles), selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect. **UNIT-IV** (7 Hrs.) **Vibrational Spectrum**: Infrared Spectrum : Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. Raman Spectrum : Concept of polarizability, pure rotational and pure vibrational, Raman spectra of diatomic molecules, selection rules. **Electronic Spectrum**: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck- Condon principle. Qualitative description of σ, π and n M.O., their energy levels and the respective transitions.
					IVth	Symmetry elements in crystals.	
					Vth	UNIT-II (8 Hrs.) **Solid State-II:** X-ray diffraction by crystals. Derivation of Bragg equation.	
				February	IInd	Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).	
					IIIrd	Applications of Powder diffraction for structure determination	
					IVth	Thermal and photochemical reaction in solid state	
					Vth	UNIT-III **Spectroscopy** : Introduction : Electromagnetic radiation, regions of the spectrum,	
				March	IInd	Basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.	
					IIIrd	**Rotational**	

						Spectrum: Diatomic molecules. Energy levels of a rigid rotor (semi – classical principles), selection rules, spectral intensity,	
					IVth	Determination of bond length, qualitative description of non-rigid rotor, isotope effect.	
					Vth	**UNIT-IV Vibrational Spectrum**: Infrared Spectrum : Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum intensity, determination of force constant and qualitative relation of force constant and bond energies,	
				April	Ist	Effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.	
					IInd	Raman Spectrum : Concept of polarizability, pure	

						rotational and pure vibrational, Raman spectra of diatomic molecules, selection rule	
					III[rd]	**Electronic Spectrum**:Concept of potential energy curves for bonding and antibondingmolecular orbitals, qualitative description of selection rules and Franck- Condon principle.	
					IV[th]	Qualitative description of s, p – and n M.O., their energy levels and the respective transitions.	

Master of Sciences			**Session 2018-2019**			**(II[nd]Semester)**
S.No.	**Teacher**	**Class**	**Paper**	**Month**	**Week**	**Syllabus**
1.	Dr. Gurpreet Kaur	M.Sc.-I	CH-421-Inorganic chemistry	January	II[nd]	**UNIT 1** **Electronic Spectra and Magnetic Properties Of Transition Metal Complexes-**Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams	**UNIT 1** **Electronic Spectra and Magnetic Properties Of Transition Metal Complexes-I (15 Hrs.)** Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d_1-d_9 states), calculations of D_q, B and β parameters, charge transfer spectra and Heteropoly Acids And Salts

					III[rd]	For transition metal complexes (d_1-d_9 states), calculations of D_q, B and β parameters,	**UNIT 2** **Electronic Spectra and Magnetic Properties Of Transition Metal Complexes-II** (15 Hrs.) Spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereo chemical information, anomalous magnetic moments, magnetic exchange coupling and spin crossover. **UNIT 3** **Metal II–Complexes** (15 Hrs.) Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls. Preparation, bonding structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes, tertiary phosphine as ligand. **UNIT 4** **Metal Cluster** (15 Hrs.) Higher boranes, carboranes, metallobranes and metallocarboranes, metal carbonyl and halide clusters, compounds with metal-metal multiple bonds.
					IV[th]	Charge transfer spectra and Heteropoly Acids And Salts **UNIT 2** **Electronic Spectra and Magnetic Properties Of Transition Metal Complexes-II** Spectroscopic method of assignment of absolute configuration in optically active metal chelates	
					V[th]	Their stereo chemical information, Anomalous magnetic moments,	

				February	Ist	Magnetic exchange coupling and spin crossover. **UNIT 3** **Metal II–Complexes** Metal carbonyls, structure and bonding	
					IInd	Vibrational spectra of metal carbonyls for bonding and structure elucidation,	
					IIIrd	Important reaction of metal carbonyls. Preparation, bonding, structure of transition metal nitrosyl,	
					IVth	Preparation, bonding, structure of transition metal dinitrogen and dioxygen complexes, tertiary phosphine as ligand.	
				March	Ist	Important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes	
					IInd	important reactions of transition metal tertiary phosphine as ligand.	
					IIIrd	**UNIT 4** **Metal Cluster** Higher boranes, carboranes, metallobranes	

					IVth	Metallocarboranes, metal carbonyl and halide clusters,	
				April	Ist	Compounds with metal-metal multiple bonds.	
2.	Dr.Rishu Jain	M.Sc-I	CH-422 Organic Chemistry-II	January	IInd	**UNIT 3** **Free Radical Reactions** Type of free radical reactions, free radical substitution mechanism at an aromatic substrate	**UNIT 3** **Free Radical Reactions (8 Hrs.)** Type of free radical reactions, free radical substitution mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation. Coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free Radical Rearrangement. Hunsdiecker reaction. **Elimination Reaction (7 Hrs.)** The E2, E1 and E1cB mechanisms and their spectrum, Orientation of the double bond. Reactivity effects of substrate structure, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination. **UNIT 4** **Pericyclic Reactions (15Hrs.)** Molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1, 3, 5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions conrotatory and disrotatory motions 4n, 4n +2 and allyl system. Cycloadditions-antarafacial suprafacial additions, 4n and 4n+2 systems, 2+2 additiion of ketenes, 1, 3-dipolar cycloadditions and cheleotropic reactions. Sigmatropic rearrangements-
					IIIrd	Neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead.	
					IVth	Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS)	
					Vth	Oxidation of aldehydes to carboxylic acids, auto-oxidation.	
				February	Ist	Coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free Radical Rearrangement. Hunsdiecker reaction.	

					II[nd]	**Elimination Reaction** The E2, E1 and E1cB mechanisms and their spectrum,	Suprafacial and antarafacial shifts of H. Sigmatropic shifts involving carbon moieties, [3, 3]-and [5, 5]- sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangement. Fluxional tautomerism. Ene reaction.
					III[rd]	Orientation of the double bond. Reactivity effects of substrate structure, attacking base,	
					IV[th]	The leaving group and the medium. Mechanism and orientation in pyrolytic elimination.	
				March	I[st]	**Pericyclic Reactions** Molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene	
					II[nd]	1, 3, 5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams.	
					III[rd]	FMO and PMO approach. Electrocyclic reactions conrotatory and disrotatory motions 4n, 4n +2 and allyl system.	
					IV[th]	Cycloadditions-antarafacial suprafacial additions, 4n and 4n+2 systems, 2+2 additiion of ketenes, 1, 3-dipolar cycloadditions	

				April	I[st]	Cheleotropic reactions. Sigmatropic rearrangements-Suprafacial and antarafacial shifts of H. Sigmatropic shifts involving carbon moieties	
					II[nd]	[3,3]-and [5,5]-sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangement. Fluxional tautomerism. Ene reaction.	
3.	Dr. Gurpree Kaurt	M.Sc.-I	CH-42 Organic chemistry-II	January	II[nd]	**UNIT 1** **Reaction Mechanism, Structure and Reactivity** Types of mechanism, types of reactions, thermodynamics and kinetic requirement.	**UNIT 1** **Reaction Mechanism, Structure and Reactivity (8 Hrs.)** Types of mechanism, types of reactions, thermodynamics and kinetic requirement. Kinetic and thermodynamics control, Hammond's postulate, Curtin-Hammett Principle, Potential energy diagrams, transition states and intermediates, method of determining mechanisms, isotope effects. **Addition to Carbon-Carbon Multiple Bonds (7 Hrs.)** Mechanistic and stereochemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic ring. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation. **UNIT 2** **Addition To Carbon-Heteroatom Multiple Bonds (15 Hrs.)** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, esters and nitriles. Addition of grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction.
					III[rd]	Kinetic and thermodynamics control, Hammond's postulate, Curtin-Hammett Principle,	
					IV[th]	Potential energy diagrams, transition states and intermediates, method of determining mechanisms, isotope effects.	
					V[th]	**Addition to Carbon-Carbon Multiple Bonds** Mechanistic and stereochemical aspects of	

						addition reaction involving electrophiles, nucleophiles	Mechanism of condensation reactions involving enolates-Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.
				February	Ist	Free radicals, regio and chemoselectivity, orientation and reactivity.	
					IInd	Addition to cyclopropane ring. Hydrogenation of double and triple bonds,	
					IIIrd	Hydrogenation of aromatic ring. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation.	
					IVth	**UNIT 2** **Addition To Carbon-Heteroatom Multiple Bonds** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds	
				March	Ist	Esters and nitriles. Addition of grignard reagents, organozinc and organolithium reagents	
					IInd	To carbonyl and unsaturated carbonyl compounds. Wittig reaction. Mechanism of condensation reactions	
					IIIrd	Involving enolates-Aldol, Knoevenagel, Claisen,	

						Mannich, Benzoin,	
					IVth	Perkin and Stobbe reactions.	
				April	Ist	Hydrolysis of esters and amides, ammonolysis of esters.	
4.	Prof. Vishal	M.Sc-I	CH-424 Group Theory, Spectroscopy and Diffraction Methods-IV	January	IInd	**UNIT 1** **Symmetry And Group Theory In Chemistry:** Symmetry elements & symmetry operation, definitions of group, subgroup,	**UNIT 1** **Symmetry And Group Theory In Chemistry: (15 Hrs.)** Symmetry elements & symmetry operation, definitions of group, subgroup, relation between orders of a finite group & its sub groups. Point group symmetry. Representations of groups by matrices (representation for the C_n, C_{nv}, C_{nn}, D_{nn} etc. group) character of a representation. The great orthogonality theorem and its importance character tables and there use-in spectroscopy. **UNIT 2** **Microwave Spectroscopy: (15 Hrs.)** Classification of molecules rigid rotor model, effect of isotopes; non rigid rotor Stark effect, nuclear and electron spin interaction & effect of external field. **Vibrational Spectroscopy:** Infrared Spectroscopy:- Linear Harmonic Oscillator, Vibrational energy of diatomic molecule zero point energy, force constants & bond lengths anharmonicity, morse potential energy diagram. Vibrational rotational spectroscopy, P, Q, R, branches. Selection rules Normal modes of vibration, group frequencies, overtones, hot bands, Raman Vibrational:- Classical & quantum theories of Raman effect pure rotational, and vibrational. Rotational Raman spectroscopy. Coherent anti stokes Raman spectroscopy.
					IIIrd	Relation between orders of a finite group & its sub groups. Point group symmetry.	
					IVth	Representations of groups by matrices (representation for the C_n, C_{nv}, C_{nn}, D_{nn} etc. group) character of a representation.	
					Vth	The great orthogonality theorem and its importance character tables and there use-in spectroscopy.	
				February	Ist	**UNIT 2** **Microwave Spectroscopy:** Classification of molecules rigid rotor model, effect of isotopes;	
					IInd	Non rigid rotor Stark	

						effect, nuclear and electron spin interaction	
					IIIrd	Effect of external field. **Vibrational Spectroscopy:** Infrared Spectroscopy:- Linear Harmonic Oscillator,	
					IVth	Vibrational energy of diatomic molecule zero point energy, force constants & bond lengths anharmonicity, morse potential energy diagram.	
				March	Ist	Vibrational rotational spectroscopy, P, Q, R, branches. Selection rules Normal modes of vibration	
					IInd	Group frequencies, overtones, hot bands,	
					IIIrd	Raman Vibrational:- Classical & quantum theories of Raman effect pure rotational,	
					IVth	Vibrational. Rotational Raman spectroscopy. Coherent anti stokes Raman spectroscopy.	

5.	Dr. Shivali Sharma	M.Sc-I	CH-424 Group Theory, Spectroscopy and Diffraction Methods-IV	January	IInd	**UNIT 3** **Molecular Spectroscopy:** Energy levels, molecular orbital, Frank Condon's Principles,	**UNIT 3** **Molecular Spectroscopy: (15 Hrs.)** Energy levels, molecular orbital, Frank Condon's Principles, electronic spectra of polyatomic molecules emission spectra; radiative & non radiative decay. Spectra of transition metal complexes; change transfer spectra. **Basic Principles Photoelectric Effect, Ionization Process:** Koopman's theorem, photoelectron spectra of simple molecule. Auger electron spectroscopy. **Diffraction:** Bragg's condition, Miller indices. Debye-Scherrer method for structure analysis. Principal and applications of neutron diffraction and electron diffraction **UNIT 4** **Magnetic Resonance Spectroscopy: (15 Hrs.)** Nuclear Magnetic Resonance Spectroscopy:- Nuclear spin, Nuclear resonance, shielding of magnetic nuclei, chemical shifts deshielding, spin spin interactions, (ABX, AMX, ABC, A_2 B_2) spin decoupling. Electron Spin resonance spectroscopy:-Basic values factors affecting 'g' value. Measurements, techniques, applications. Nuclear Quadrupole Resonance spectroscopy:- Quadrupole Nuclear moments, electic field gradient complex constants applications.
					IIIrd	Electronic spectra of polyatomic molecules emission spectra; radiative & non radiative decay	
					IVth	Spectra of transition metal complexes; change transfer spectra.	
					Vth	**Basic Principles Photoelectric Effect, Ionization Process:** Koopman's theorem, photoelectron spectra of simple molecule.	
				February	Ist	Auger electron spectroscopy. **Diffraction:** Bragg's condition, Miller indices.	
					IInd	Debye-Scherrer method for structure analysis. Principal and applications of neutron diffraction and electron diffraction	

					III[rd]	**UNIT 4** **Magnetic Resonance Spectroscopy: (15 Hrs.)** Nuclear Magnetic Resonance Spectroscopy:- Nuclear spin, Nuclear resonance, shielding of magnetic nuclei,	
					IV[th]	Chemical shifts deshielding, spin spin interactions, (ABX, AMX, ABC, A_2 B_2) spin decoupling.	
				March	I[st]	Electron Spin resonance spectroscopy:-Basic values factors affecting 'g' value.	
					II[nd]	Measurements, techniques, applications	
					III[rd]	Nuclear Quadrupole Resonance spectroscopy:- Quadrupole Nuclear moments,	

					IVth	Electic field gradient complex constants applications.	
6.	Dr. Geeta Jallan	M.Sc.-I	CH-423 Physical Chemistry-III	January	IInd	**UNIT 1** **Chemical Dynamics:** Methods of determining rate laws, ionic reactions*, kinetic salt effects, steady state kinetics	**UNIT 1** **Chemical Dynamics: (15 Hrs.)** Methods of determining rate laws, ionic reactions*, kinetic salt effects, steady state kinetics, kinetic & thermodynamic control of reactions, treatments of unimolecular reactions, Dynamic chain (pyrolysis of acetaldehyde composition of ethane), photochemical (H_2-Cl_2) reactions & oscillatory reactions (Belousov-Zhabotinsky reaction), homogeneous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis, and NMR method, dynamics of molecular motion, probing the transition state, dynamics of barrierless chemical reactions in solution, dynamics of unimolecular reaction (Lindemann-Hinshelwood and Rice-Ramsperger-Kassel-Marcus Theories of unimolecular reactions) **UNIT 2** ***Non-equilibrium Thermodynamics:*** **(15Hrs.)** Thermodynamic criteria for non eqbm states, entropy production and entropy flow, entropy balance eqns for different irreversible processes (eg. heat flow, chemical reaction etc.), transformation of generalized fluxes and forces, noneqbm stationary states, phenomenological equators, microscopic reversibility and onsager's reciprocity relations, electro kinetic phenomenon, diffusion, electrical conduction, irreversible thermodynamics for biological system, coupled reactions.
					IIIrd	Kinetic & thermodynamic control of reactions, treatments of unimolecular reactions, Dynamic chain (pyrolysis of acetaldehyde composition of ethane),	
					IVth	Photochemical (H_2-Cl_2) reactions & oscillatory reactions (Belousov-Zhabotinsky reaction), homogeneous catalysis, kinetics of enzyme reactions,	
					Vth	General features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis, and NMR method,	

				February	Ist	Dynamics of molecular motion, probing the transition state, dynamics of barrierless chemical reactions in solution,	*Macromolecules:* Electrically conducting, fire resistant, liquid crystal polymers, Kinetics of polymerization, mechanism of polymerization, mol.mass determination (osmometry, viscometry, diffusion & light scattering methods), sedimentation, chain config. of macromolecules, calculation of average dimensions.
					IInd	Dynamics of unimolecular reaction (Lindemann-Hinshelwood and Rice-Ramsperger-Kassel-Marcus Theories of unimolecular reactions)	
					IIIrd	**UNIT 2** ***Non-equilibrium Thermodynamics:*** Thermodynamic criteria for non eqbm states, entropy production and entropy flow,	
					IVth	Entropy balance eqns for different irreversible processes (eg. heat flow, chemical reaction etc.), transformation of generalized fluxes and forces,	
				March	Ist	Noneqbm stationary states, phenomenological equators, microscopic reversibility and onsager's reciprocity relations,	

					II[nd]	Electro kinetic phenomenon, diffusion, electrical conduction,	
					III[rd]	Irreversible thermodynamics for biological system, coupled reactions.	
					IV[th]	*Macromolecules:* Electrically conducting, fire resistant, liquid crystal polymers, Kinetics of polymerization,	
				April	I[st]	Mechanism of polymerization, mol.mass determination (osmometry, viscometry, diffusion & light scattering methods),	
					II[nd]	Sedimentation, chain config. of macromolecules, calculation of average dimensions.	
7.	Prof. Vishal	M.Sc-I	CH-423 Physical Chemistry-III	January	II[nd]	**UNIT 3** **Surface Chemistry** **Adsorption:** Surface tension, capillary action, pressure difference across	**UNIT 3** **Surface Chemistry (15 Hrs.)** **Adsorption:** Surface tension, capillary action, pressure difference across curved surface (Laplace eqn), vapour pressure of droplets, (Kelvin eqn), Gibb's adsorption isotherm,

						curved surface (Laplace eqn), vapour pressure of droplets	estimation of surface area (BET eqn), surface films on liquids (electro kinetic phenomenon), catalytic activity at surfaces. **Micelles:** Surface active agents, classification of surface active agents, micellisation, hydrophobic interactions, critical micellar concentration, factors affecting CMC of surfactants, counter ions binding to micelles, thermodynamics of micellization-phase separation & mass action models, solubilization, microemulsion, reverse micelles. **UNIT 4** **Electrochemistry: (15 Hrs.)** Electrochemistry of solutions, Debye-Huckel treatment, and its extension, ion solvent interaction, Debye-Huckel-Jerrum model, Thermodynamics of electrified interface equations, derivation of electrocapillarity, Lippmann equations (surface excess), Methods of determining structures of electrified interfaces, Guoy-Chapman, Stern. Over potentials, exchange current density, derivation of Butler-volmer equation. Tafel plots. Quantum aspects of charge transfer at electrode solution interfaces, quantization of charge transfer, tunnelling Semiconductor interfaces- theory of double layer interfaces, effects of light at semiconductor solution interface. **Electrocatalysis** : Influence of various parameters, H-electrode, polarography, theory Ilkovic eqn, (excluding derivation), Half wave potential & its significance, electrocardiography, introduction to corrosion, homogeneous, theory, forms of corrosion, corrosion monitoring.
					IIIrd	(Kelvin eqn), Gibb's adsorption isotherm, estimation of surface area (BET eqn), surface films on liquids (electro kinetic phenomenon),	
					IVth	Catalytic activity at surfaces. **Micelles:** Surface active agents, classification of surface active agents, micellisation, hydrophobic interactions,	
					Vth	Critical micellar concentration, factors affecting CMC of surfactants, counter ions binding to micelles, thermodynamics of micellization-phase separation	

				February	Ist	Mass action models, solubilization, microemulsion, reverse micelles.	
					IInd	**UNIT 4** **Electrochemistry:** Electrochemistry of solutions, Debye-Huckel treatment, and its extension, ion solvent interaction, Debye-Huckel-Jerrum model,	
					IIIrd	Thermodynamics of electrified interface equations, derivation of electrocapillarity, Lippmann equations (surface excess), Methods of determining structures of electrified interfaces,	
					IVth	Guoy-Chapman, Stern. Over potentials, exchange current density, derivation of Butler-volmer equation. Tafel plots.	
				March	Ist	Quantum aspects of charge transfer at electrode solution interfaces, quantization of charge transfer, tunnelling	

					II[nd]	Semiconductor interfaces-theory of double layer interfaces, effects of light at semiconductor solution interface.	
					III[rd]	**Electrocatalysis** : Influence of various parameters, H-electrode, polarography, theory Ilkovic eqn, (excluding derivation),	
					IV[th]	Half wave potential & its significance, electrocardiography,	
				April	I[st]	Introduction to corrosion, homogeneous, theory, forms of corrosion,	
					II[nd]	Corrosion monitoring.	

Master of Sciences		Session 2018-2019					(IV^{th} Semester)
S.No.	**Teacher**	**Class**	**Paper**	**Month**	**Week**		**Syllabus**
1.	Dr. Arwinder Kaur	M.Sc-II	CH-522 (III) Organic Synthesis – I	January	II^{nd}	**UNIT 2** **Organic Synthesis** Linear & Conversion Synthesis, Reterosynthetic Approach,	**UNIT 2** **Organic Synthesis (15 Hrs.)** Linear & Conversion Synthesis, Reterosynthetic Approach, Umpolung, Regeoselectivity, Chemoselectivity and Diastereoselectivity, Cram's Rule, Felkin-Ahn Model (with relevant examples) **UNIT 4** **Rearrangements (15 Hrs.)** General mechanistic considerations-nature of migration, migratory aptitude, memory effects A detailed Study of the following rearrangements Pinacol-pinacolone, Wagner-Meerwein, Demjanov, Benzil- Benzilic Acid, Favorskii, Arndt Eistert synthesis, Neber, Beckmann, Hofman, Curtius, Schmidt, Baeyer- Villiger, Shapiro reaction.
					III^{rd}	Umpolung, Regeoselectivity, Chemoselectivity	
					IV^{th}	Diastereoselectivity, Cram's Rule,	
					V^{th}	Felkin-Ahn Model (with relevant examples)	
				February	I^{st}	**UNIT 4** **Rearrangements** General mechanistic considerations-nature of migration,	
					II^{nd}	Migratory aptitude, memory effects	

					III[rd]	A detailed Study of the following rearrangements Pinacol-pinacolone,	
					IV[th]	Wagner-Meerwein, Demjanov,	
				March	I[st]	Benzil- Benzilic Acid, Favorskii	
					II[nd]	Arndt Eistert synthesis, Neber,	
					III[rd]	Beckmann, Hofman,	
					IV[th]	Curtius, Schmidt, Baeyer-Villiger,	
				April	I[st]	Shapiro reaction	
2.	Dr. Shivali Sharma	M.Sc-II	CH-522 (III) Organic Synthesis – I	January	II[nd]	**UNIT 1** **Organometallic Reagents** Principle, Preparations, properties and applications of Organolithium and organomagnesium compounds	**UNIT 1** **Organometallic Reagents (15 Hrs.)** Principle, Preparations, properties and applications of the following in organic synthesis with mechanistic details **Organolithium and organomagnesium compounds :** Hg, Zn and Ce Compounds **Transition metals**: Cu,Pd,Ni, Fe , Co, Rh ,Cr and Ti Compounds **Other elements** : Si ,B and iodine (I) Compounds **UNIT 3** **Oxidation (7 Hrs.)** Introduction. Different oxidative Processes Hydrocarbon-alkenes, aromatic rings, saturated C-H groups(activated and Unactivated) Alcohols, diols, aldehydes, ketones, ketals and
					III[rd]	Principle, Preparations, properties and applications of Hg, Zn and Ce Compounds	
					IV[th]	Principle, Preparations, properties and applications of Cu,Pd	

					Vth	Principle, Preparations, properties and applications of Ni, Fe , Co	carboxylic acids, amines, hydrazines, and sulphides. Oxidation with ruthenium tetaoxide, iodobenzene diacetate and Thallium(III) nitrate. **Reduction (8 Hrs.)** Introduction Different reductive processes Hydrocarbons-alkanes, alkenes, alkynes and aromatic rings carbonyl compounds-aldehydes, ketones, acids and their derivatives. epoxides. nitro, nitroso, azo and oxime groups. Hydrogenolysis.
				February	Ist	Principle, Preparations, properties and applications of	
					IInd	Principle, Preparations, properties and applications of Co, Rh ,Cr	
					IIIrd	Principle, Preparations, properties and applications of Ti Compounds, Si ,B and iodine (I) Compounds	
					IVth	**UNIT 3** **Oxidation** Introduction. Different oxidative Processes Hydrocarbon-alkenes, aromatic rings,	
				March	Ist	Saturated C-H groups(activated and Unactivated) Alcohols, diols,	
					IInd	Aldehydes, ketones, ketals and carboxylic acids, amines,	
					IIIrd	Hydrazines, and sulphides. Oxidation with ruthenium tetaoxide, iodobenzene diacetate and Thallium(III) nitrate.	

					IVth	**Reduction** Introduction Different reductive processes Hydrocarbons-alkanes, alkenes,	
				April	Ist	Alkynes and aromatic rings carbonyl compounds aldehydes, ketones, acids and their derivatives. epoxides.	
					IInd	Nitro, nitroso, azo and oxime groups. Hydrogenolysis.	
3.	Dr. Arwinder Kaur	M.Sc-II	CH-523 (III) Chemistry of Natural Products	January	IInd	**UNIT 1** **Terpenoids and Carotenoids** Classification, nomenclature occurrence isolation general methods of structure determination,	**UNIT 1** **Terpenoids and Carotenoids (15 Hrs.)** Classification, nomenclature occurrence isolation general methods of structure Determination, isoprene rule. Structure determination stereochemistry, Biosynthesis and synthesis of the following representative molecules: citral ,Terpeneol, Farnesol, santonin, phytol, Abietic Acid and Beta-Carotene **UNIT 2** **Alkaloids (15 hrs.)** Definition, nomenclature and physiological action, occurrence isolation, general method of structure elucidation, degradation classification based on nitrogen heterocyclic ring role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following: Ephedrine, (+)- Conine, Nicotine, Atropine, Quinine and Morphine
					IIIrd	Isoprene rule. Structure determination stereochemistry, Biosynthesis and synthesis of citral ,Terpeneol	
					IVth	Structure determination stereochemistry, Biosynthesis and synthesis of Farnesol, santonin	
					Vth	Structure determination stereochemistry, Biosynthesis and synthesis of phytol, Abietic Acid	

				February	Ist	Structure determination stereochemistry, Biosynthesis and synthesis of Beta-Carotene	
					IInd	**UNIT 2** **Alkaloids** Definition, nomenclature and physiological action occurrence, isolation, general method of structure elucidation	
					IIIrd	Degradation classification based on nitrogen heterocyclic ring role of alkaloids in plants.	
					IVth	Structure, stereochemistry, synthesis and biosynthesis of Ephedrine,	
				March	Ist	Structure, stereochemistry, synthesis and biosynthesis of (+)- Conine	
					IInd	Structure, stereochemistry, synthesis and biosynthesis of Nicotine	
					IIIrd	Structure, stereochemistry, synthesis and biosynthesis of Atropine	
					IVth	Structure, stereochemistry, synthesis and biosynthesis of Quinine	
				April	Ist	Structure, stereochemistry, synthesis and biosynthesis	

						of Morphine	
4.	Dr. Shivali Sharma	M.Sc-II	CH-523 (III) Chemistry of Natural Products	January	II[nd]	**UNIT 3** **Steroids** Occurrence nomenclature basic skeleton. Diel's hydrocarbon and Stereochemistry	**UNIT 3** **Steroids (15 Hrs.)** Occurrence nomenclature basic skeleton. Diel's hydrocarbon and Stereochemistry Isolation, structure determination and synthesis of cholesterol, Bile acids, Androsterone ,Testosterone, Estrone, Progestrone, Aldosterone. Biosynthesis of Steroids **UNIT 4** **Plant Pigments (5 Hrs.)** Occurrence nomenclature and general methods of structure determinations, isolation and synthesis ,Quercetin , Quercetin-3-Glucoside Vitexin, Diadzein, Cyanidin-7-arabinoside cyanidine, Hirsutidin Biosynthesis of Flavonoids: Acetate path way and shikimic acid path way. **Porphyrins (3 Hrs.)** Structure and synthesis of Haemoglobin and chlorophyll **Prostaglandins (5 Hrs.)** Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF 2 **Pyrethroids and rotenones : (2 Hrs.)** Synthesis and reaction of Pyrethroids and rotenones
					III[rd]	Isolation, structure determination and synthesis of cholesterol	
					IV[th]	Isolation, structure determination and synthesis of Bile acids, Androsterone ,Testosterone	
					V[th]	Isolation, structure determination and synthesis of Estrone, Progestrone, Aldosterone	
				February	I[st]	**UNIT 4** **Plant Pigments** Occurrence nomenclature and general methods of structure determinations,	
					II[nd]	Isolation and synthesis of ,Quercetin , Quercetin-3-Glucoside, Vitexin,	
					III[rd]	Isolation and synthesis of Diadzein, Cyanidin-7-arabinoside cyanidine,	
					IV[th]	Isolation and synthesis of Hirsutidin Biosynthesis of Flavonoids: Acetate path	

						way and shikimic acid path way.	
				March	Ist	**Porphyrins** Structure and synthesis of Haemoglobin	
					IInd	Structure and synthesis of chlorophyll	
					IIIrd	**Prostaglandins** Occurrence, nomenclature, classification, biogenesis and physiological effects	
					IVth	Synthesis of PGE2 and PGF 2	
				April	Ist	**Pyrethroids and rotenones :** Synthesis and reaction of Pyrethroids	
					IInd	Synthesis and reaction of rotenones	
5.	Dr. Geeta Jallan	M.Sc.-II	CH-524(IV) Photochemistry and Solid state	January	IInd	**UNIT 3** **Solid state chemistry** **Solid state reactions** General principles, experimental procedures, co-precipitation as a precursor to solid state reactions,	**UNIT 3** **Solid state chemistry** **Solid state reactions (4 Hrs.)** General principles,experimental procedures, co-precipitation as a precursor to solid state reactions, kinetics of solid state reactions. **Crystal defects and non-stochiometry (6 Hrs.)** Perfect and imperfect crystals, intrinsic and extrinsic defects-point defect, line defects, vacancies-Schottky defects and Frenkel defects. Thermodynamics of Schottky defects and Frenkel defect formation, colour centers, non-stoichiometry and defects. **Organic solids (5 Hrs.)**
					IIIrd	Kinetics of solid state reactions. **Crystal defects and non-stochiometry** Perfect and imperfect crystals,	

					IVth	Intrinsic and extrinsic defects-point defect, line defects, vacancies-Schottky defects	Electrically conducting solids, organic charge transfer complex, organic metals, new superconductors. **UNIT 4** **Electronic properties and Band Theory (15 Hrs.)** Metals, insulators and semiconductors, electronic structure of solids-band theory of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors. doping semiconductors, p-n junctions, superconductors. Optical properties-Optical reflectance, photoconduction-photoelectric effects. Magnetic properties-Classification of materials: Quantum theory of paramagnetics cooperative phenomena-magnetic domains, hysteresis.
					Vth	Frenkel defects. Thermodynamics of Schottky defects and Frenkel defect formation,	
				February	Ist	Colour centers, non-stoichiometry and defects. **Organic solids** Electrically conducting solids, organic charge transfer complex,	
					IInd	Organic metals, new superconductors. **UNIT 4** **Electronic properties and Band Theory** Metals, insulators and semiconductors,	
					IIIrd	Electronic structure of solids-band theory of metals, insulators and semiconductors,	

					IVth	Intrinsic and extrinsic semiconductors. doping semiconductors, p-n junctions	
				March	Ist	Superconductors. Optical properties-Optical reflectance, photoconduction-	
					IInd	Photoelectric effects. Magnetic properties-Classification of materials:	
					IIIrd	Quantum theory of paramagnetics cooperative phenomena	
					IVth	Magnetic domains, hysteresis.	
6.	Dr. Gurpreet Kaur	M.Sc-II	CH-524(IV) Photochemistry and Solid state	January	IInd	**UNIT 1** **Photochemistry** **Photochemical Reactions** Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule,	**UNIT 1** **Photochemistry** **Photochemical Reactions (4 Hrs.)** Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield ,transfer of excitation energy, actinometry **Determination of reaction mechanism (5Hrs.)** Classification, rate constants and life times of reactive energy

					III[rd]	Quantum yield ,transfer of excitation energy, actinometry	states –determination of rate constants of reaction. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reaction–photo-dissociation, gas –phase photolysis. **Photochemistry of Alkenes (6 Hrs.)** Interamolecular reaction of the olefinic bond-geometrical isomerism, cyclisation reaction, rearrangementof 1,4- and 1,5-dienes **UNIT 2** **Photochemistry of Carbonyl compound (7Hrs.)** Intramolecular reaction of carbonyl compounds saturated,cyclic and acyclic β γ unsaturated and α-β unsaturated compounds. Cyclohexadienes. intermolecular cycloadditio reactions—dimerisation and oxetane formation. **Photochemistry of aromatic compounds (4 Hrs.)** Isomerisations, additions and substitutions. **Miscellaneous photochemical reactions (4 Hrs.)** Photofries reactions of anilids. photo-fries rearrangement. Barton reaction. singlet molecular oxygen reactions. photochemical formation of smog. photodegradation of polymers. photochemistry of vision.
					IV[th]	**Determination of reaction mechanism** Classification, rate constants and life times of reactive energy states –determination of rate constants of reaction	
					V[th]	Effect of light intensity on the rate of photochemical reactions. Types of photochemical reaction	
				February	I[st]	Photo-dissociation, gas –phase photolysis. **Photochemistry of Alkenes** Interamolecular reaction of the olefinic bond	
					II[nd]	Geometrical isomerism, cyclisation reaction, rearrangementof 1,4- and 1,5-dienes	

					III[rd]	**UNIT 2** **Photochemistry of Carbonyl compound** Intramolecular reaction of carbonyl compounds saturated,cyclic and acyclic	
					IV[th]	β γ unsaturated and α- β unsaturated compounds. Cyclohexadienes. intermolecular cycloadditio reactions—dimerisation and oxetane formation.	
				March	I[st]	**Photochemistry of aromatic compounds** Isomerisations, additions and substitutions.	
					II[nd]	**Miscellaneous photochemical reactions** Photofries reactions of anilids. photo-fries rearrangement.	
					III[rd]	Barton reaction. singlet molecular oxygen reactions.	

					IVth	Photochemical formation of smog.	
				April	Ist	Photodegradation of polymers.	
					IInd	Photochemistry of vision.	

End Semester Examinations	**10-05-19**	**To**	**30-05-19**	**(17 days)**
	Friday		**Thursday**	
Summer vacation	**31-05-19**	**To**	**07-07-19**	**(38 days)**
(tentative)	**Friday**		**Sunday**	

Total teaching days of academic term I & II 97+83 =180 days