Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Biosciences

Lesson Plan - B. Sc. I Year (July 2020 - April 2021)

Subject - Chemistry - I Paper : Physical Chemistry

Teacher - Prof. Deepanshu Pandey

Day/Lecture	Unit	Topic
1	Unit 1	**A. Mathematical Concept :**
2	Unit 1	Logarithm relations (rules & types)
3	Unit 1	Use of log table and antilog table in calculation
4	Unit 1	Curve sketching (Straigth line and linear graphs), Calculation of slopes
5	Unit 1	Differentiation of functions like Kx,sin x, log x
6	Unit 1	Multiplication and division in differentiation
7	Unit 1	maxima and minima
8	Unit 1	partial differentiation, Integration of some useful/ relevent functions
9	Unit 1	Factorials
10	Unit 1	Probability
11	Unit 1	Revision of chapter after completion of unit
12	Unit 1	**B. Gaseous States and Molecular Velocitites :**
13	Unit 1	Critical Phenomenon: PV isotherm of ideal gases
14	Unit 1	Andrew's experiment
15	Unit 1	Continuity of state
16	Unit 1	Isotherms of van der waal's equation
17	Unit 1	relationship between critical constants and vander waals constants
18	Unit 1	Root mean square,average & most probable velocitites
19	Unit 1	Qualitative discussion of the Maxwell's distribution of molecular velocities
20	Unit 1	collision numbers, mean free path and collision diameter
21	Unit 2	**A. Liquid States :** Intermolecular forces , structure of liquids, Liquid crystals
22	Unit 2	Difference between liquid crystal,solid & liquid
23	Unit 2	classification, structure of nematics and cholestric phases
24	Unit 2	Thermography, & seven segment cell
25	Unit 2	**B. Solid State :** Defination of space lattice, Unit cell
26	Unit 2	Laws of crystallography : (a) Law of constancy of interfacial angles,
27	Unit 2	(b) law of rationality of indices (c) law of symmetry
28	Unit 2	Symmetry elements in crystal, ionic solid structures, Radius Ratio effect
29	Unit 2	Coordination number, limitation of radius rule lattice defects
30	Unit 2	Revision of chapter after completion of unit
31	Unit 3	**Chemical Kinetics :** Chemical kinetics and its scope,rate of a reaction
32	Unit 3	Factors affecting rate : Conc, temp., solvent,light,catalyst,pressure
33	Unit 3	Dependence of rate on concentration,
34	Unit 3	Mathematical characteristic of simple chemical reaction: Zero order, First order, Second, Pseudo
35	Unit 3	half life and mean life, Determination of the order of reaction
36	Unit 3	Differential method, half life method
37	Unit 3	Determination of the order of reaction by integration method
38	Unit 3	study of chemical kinetics by polarimetry
39	Unit 3	study of chemical kinetics by spectrophotometery
40	Unit 3	Effect of temperature on rate of reaction
41	Unit 3	Arrhenius equation,Concept of activation energy
42	Unit 3	Simple collision theory, transition state theory
43	Unit 3	Revision of chapter after completion of unit
44	Unit 4	**Radioactivity and Nuclear Chemistry** : Natural and artificial radioactivity
45	Unit 4	radioactive radiations, detection and measurmentof radioactivity
46	Unit 4	Group displacement law of soddy
47	Unit 4	radioactive disintegration, nuclear reaction : nuclear fussion & nuclear fission
48	Unit 4	half life period, isotopes, isobars and isomers
49	Unit 4	application of radiochemistry
50	Unit 4	Revision of chapter after completion of unit
51	Unit 5	**A. Chemical Equilibrium:** Law of mass action, Equilibrium constant
52	Unit 5	Le chatelier's Principles
53	Unit 5	**B. Colloidal Solutions :** Classification, lyophilic and lyophobic colloids
54	Unit 5	Properties : kinetics, optical
55	Unit 5	Properties : electrical, coagulation
56	Unit 5	Hardy- Schulze rule, Gold number
57	Unit 5	emulsions, gels and sols
58	Unit 5	application of colloids
59	Unit 5	Revision of chapter after completion of unit

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Biosciences

Lesson Plan - B. Sc. I Year (July 2020 - April 2021)

Subject - Chemistry - II Paper :Inorganic Chemistry

Teacher - Prof. Deepanshu Pandey

Day/Lecture	Unit	Topic
1	Unit 1	**(a) Atomic Structure :** Dual Nature of matter,idea of de Broglie matter waves
2	Unit 1	Heisenberg uncertainity principle, atomic orbital
3	Unit 1	Schrodinger wave equation,Significance of $\bar{Y}$ and $\bar{Y}$
4	Unit 1	quantum numbers, radial and angular wave functions
5	Unit 1	probability distribution curves, shapes of s,p,d, orbitals
6	Unit 1	Aufbau and pauli exclusion principles, Hund's multiplicity rule
7	Unit 1	Electronic configuration of the elements, effective nulcear charge
8	Unit 1	**(b) Periodic Properties :** Atomic and ionic radii , ionization energy
9	Unit 1	electron affinity , electronegativity- defination, methods of determination or evaluation
10	Unit 1	treands in periodic table and applications in predicting and explaing chemical behaviuor
11	Unit 1	Revision after the completion of the unit.
12	Unit 2	**(a) Chemical Bonding Part I :** Covalent Bond- Valence bond theory and its limitations
13	Unit 2	directional characteristic of covalent bond
14	Unit 2	various types of hybridization and shapes of simple inorganic molecules and ions
15	Unit 2	Valence shell electron pair repulsion (VSEPR) theory to NH3
16	Unit 2	Valence shell electron pair repulsion (VSEPR) theory to H3O,SF4,ClF3 and H2O
17	Unit 2	MO theory, Homonuclear and heteronuclear (CO and NO)4 diatomic molecules
18	Unit 2	multicenter bonding in elctron deficient molecules
19	Unit 2	bond strength and bond energy
20	Unit 3	**(a) Chemical Bonding Part II : Ionic Solids :** Ionic structures, radius ratio effect
21	Unit 3	coordination number, limitation of radius ratio rule
22	Unit 3	lattice defects,semi conductors, lattice energy
23	Unit 3	Born Haber cycle,
24	Unit 3	solvation energy & solubility of ionic solids
25	Unit 3	polarizing power and polarisability of ions
26	Unit 3	Fajan's rule, metallic bond-free electron, valence bond
27	Unit 3	Band theories
28	Unit 3	(b) **Weak Interaction**- Hydrogen bonding, van der waals forces
29	Unit 3	**Chemistry of Noble Gases:** chemical properties of the noble gases
30	Unit 3	chemistry of xenon
31	Unit 3	structure and bonding in xenon compounds
32	Unit 4	**1.S-Block Elements :** Comparative study Li and Mg
33	Unit 4	diagonal relationships, slient features of hydrides, solvation and complexation
34	Unit 4	tnedencies including their function in biosystemsan introduction to alkyls and aryls
35	Unit 4	**2.P-Block Elements I :** Comparative study Be and Al
36	Unit 4	diagonal relationship of groups 13-17 elements
37	Unit 4	Compounds like hydrides, oxides
38	Unit 4	oxyacids of groups 13-16
39	Unit 4	halide of groups 13-16
40	Unit 5	**p-Block Elements part II:** Hydrides of boron-diborane and higher boranes
41	Unit 5	Hydrides of boron-diborane and higher boranes
42	Unit 5	borazine borohydrides
43	Unit 5	Fullerenes, Fluorocarbons
44	Unit 5	silicates (structural principle)
45	Unit 5	tetrasulphur tetranitride
46	Unit 5	Basic properties of haolgens
47	Unit 5	Interhalogens and polyhalides
48	Unit 5	Revision after the completion of the unit.
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Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Biosciences

Lesson Plan - B. Sc. I Year (July 2020 - April 2021)

Subject - Chemistry - III Paper :Organic Chemistry

Teacher - Prof. Deepanshu Pandey

Day/Lecture	Unit	Topic
1	Unit 1	**Structure and Bonding** : Hybridization
2	Unit 1	Bond lengths and bond angles, bond energy
3	Unit 1	localized and delocalized chemical bond
4	Unit 1	inclusion compounds,clatherates
5	Unit 1	charge transfer complexes
6	Unit 1	resonance,hyperconjugation
7	Unit 1	inductive, electromeric, mesomeric and steric effect
8	Unit 1	**Mechanism of Organic Reaction:** homolytic and heterolytic bond fission
9	Unit 1	Types of reagents- electrophiles and nucleophiles
10	Unit 1	Types of organic reaction, energy consideration
11	Unit 1	Methods of determination of reaction mechanism(active intermediate products)
12	Unit 1	isotopes effects, kinetics and stereochemical studies
13	Unit 1	Revision on completion of the unit
14	Unit 2	**Alkanes and cycloalkanes:** IUPAC nomenclature of branched and unbranched alkanes
15	Unit 2	classification of alkanes, isomerism in alkanes
16	Unit 2	methods of formation (Wurtz rxn, Kobe Rxn, Corey House Rxn, Decarboxylation)
17	Unit 2	physical and chemical reaction of alkanes
18	Unit 2	conformation of alkanes
19	Unit 2	mechanism of free radical halogenation of alkanes
20	Unit 2	**cycloalkanes-**nomenclature, methods of formation,
21	Unit 2	chemical reaction, Baeyer strain theory and its limitation
22	Unit 2	Theory of strainless rings
23	Unit 2	The case of cyclopropane ring : Banana bonds
24	Unit 2	conformation of cycloalkanes
25	Unit 2	Revision on completion of the unit
26	Unit 3	**Alkene, Cycloalkenes,Dienes :** Nomenclature of alkenes
27	Unit 3	methods of formation - mechanism of dehydration of alcohols and dehydrogenation of alkyl halides
28	Unit 3	ragioselectivity in alcohol dehydration
29	Unit 3	The saytzeff rule
30	Unit 3	Hofmann elimination
31	Unit 3	physical properties and relative satbilities of alkenes
32	Unit 3	Chemical reaction of alkenes- mechanism involved in hydrogenation
33	Unit 3	electrophilic and free radical addition
34	Unit 3	Markownikoff's rule
35	Unit 3	hydroboration- oxidation , oxymercuration reduction
36	Unit 3	Epoxidation, ozonolysis
37	Unit 3	polymerization of alkenes
38	Unit 3	substitution of allylic and vinylic positions
39	Unit 3	application of ethylene and propene
40	Unit 3	Methods of formation, conformation and chemical reactions of cycloalkanes
41	Unit 3	Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes
42	Unit 3	structure of allenes and butadiene
43	Unit 3	methods of formation
44	Unit 3	polymerisation
45	Unit 3	Chemical reaction- 1,2 and 1,4 addition
46	Unit 3	Diels- Alder reaction
47	Unit 3	Revision on completion of the unit

48	Unit 4	**Alkynes and Alkyl Halides :** Nomenclature, structure and bonding of alkynes
49	Unit 4	Methods of formation, chemcial reactions
50	Unit 4	acidity of alkynes, Mechanism of electroplilic and nucleophilic addition reaction
51	Unit 4	hydroboration oxidation , metal- ammonia reduction- oxidation
52	Unit 4	polymerization of alkynes
53	Unit 4	Nomenclature and classification of alkyl halides
54	Unit 4	methods of formation, chemical reactions
55	Unit 4	Mechanism of nucleophilic substitution reaction of alkyl halides
56	Unit 4	SN 1 and SN 2 reaction with energy profile diagrams
57	Unit 4	Elimination reaction
58	Unit 4	Polyhalogen compounds : methods of preperation
59	Unit 4	properties of chloroform and carbon tetrachloride
60	Unit 4	Revision on completion of the unit
61	Unit 5	**Stereochemistry of Organic compounds :** Concept of isomerism
62	Unit 5	types of isomerism
63	Unit 5	optical isomerism, elements of symmetry
64	Unit 5	moleculare chirality
65	Unit 5	enantionmers, stereogenic centre
66	Unit 5	optical activity, properties of enantiomers
67	Unit 5	chiral and achiral molecules with two stereogenic centres
68	Unit 5	diastereomers, threo and erthro enantiomers
69	Unit 5	inversion,retention and racemization
70	Unit 5	Relative and absolute configuration, sequence rule
71	Unit 5	D & L and R & S systems of nomenclature
72	Unit 5	Geometrical isomerism - determination of configuration of geometric isomers
73	Unit 5	E & Z system of nomenclature
74	Unit 5	geometric isomerism in oximes and alicyclic compounds
75	Unit 5	Revision on completion of the unit

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Biosciences

Lesson Plan - B. Sc. I Year (July 2020 - April 2021)

Subject - Chemistry Practical

Teacher - Prof. Deepanshu Pandey

Day/Lecture	Unit	Topic
1		**Physical Chemistry : An introduction**
		(A) Any one experiment :
2		(i) Determination of melting point
3		(ii) Determination of boiling point
4		(iii) Weighing and preparation of solution
		(B) Any one experiment :
5		(i) Determination of surface tension/percentage composition of given liquid mixture using surface tension method
6		(ii) Determination of viscocity/ percentage composition of given liquid mixture using viscocity method.
7		**Inorganic Chemistry : An introdution**
8 to 18		(i) Inorganic mixture analysis
		Mixture analysis for 2 cation and 2 anions
19 to 20		(ii) Separation of cations by paper chromatography
		Organic Chemistry (Any two)
21		(i) Crystallization
22		(ii)Sublimation
23 to 25		(iii) Detection of elements
26 to 32		(iv) Identification of functional group

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Chemical Science

Lesson Plan - B.Sc. II Year (July 2020 - April 2021)

Subject - Chemistry Paper I(Physical Chemistry)

Teacher - Prof. Seema Shintre

Day/Lecture	Unit	Topic
	1	**Thermodynamics**
1		Basic concepts - system,surrounding, Extensive and intensive properties, types of process,
2		Exothermic and Endothermic process, reversible and irreversible process, Internal energy
3		First law of thermodynamics, Enthalpy, Heat and work
4		Molar heat capacity, Joule Thomson effect and its coefficient
5		Expansion of ideal gases for isothermal and adiabatic process
6		Second law of thermodynamics, Carnot cycle
7		Carnot theorem, thermodynamic scale of temprature
8		Concept of Entropy and entropy change in Carnot cycle
9		Entropy change of ideal gas in term of P &T and V &T
10		Physical significance of entropy , Claussius inequility
11		Entropy of mixing, entropy and probability
12		Third law of thermodynamics (**Nernst heat theoram**), work function
13		Concept of Free energy and Gibb's Helmholtz equation in term of work function and internal energy
		and in term of Free energy and enthalpy
		Thermochemistry
14		Hess's law and Heat of reaction
15		Bomb colorimeter, Heat of neutralization
16		Bond energy and its factors, Kirchaff's equation
	2	**Phase Equilibrium**
17		Statement and the meaning of terms: phase, component and the degree of freedom
18		Thermodynamic derivation of the Gibbs phase rule
19		One component system: water system, CO_2 system
20		Sulphur system
21		Two component system: solid liquid equilibrium, simple eutectic system: Bi-Cd system
22		Pb-Ag system and desilverisation of lead
		Solid solution
23		Type B system: Zn-Mg system
24		NaCl-H_2O system, copper sulphate water system
		Liquid liquid mixture
25		Raoult's law and Henry's law
26		Ideal and non-ideal solutions
27		Azeotrops: HCl-H_2O and ethanol water system
		Partial miscible liquids
28		Phenol-water, trimethylamine-water and nicotine-water system
29		Lower and upper consolute temperature, steam distillation
30		Nernst distribution law: thermodynamic derivation, application.
	3	**Electrochemistry-I**
31		Electrical transport, conduction in metal and electrolyte solutions
32		Resistance, conductance,Specific and equivalent conductivity
33		Measurment of equivalent conductance, effect of dilution on conductivity
34		Migration of ions and Kohlrausch law and application
35		Arrhenius theory of electrolyte dissociation and its limitations
36	.	Weak and strong electrolytes, Ostwald's dilution law
37		Debye Huckel theoryad DHO equation
38		Transport number, Hittorf method
39		Moving boundary method
	4	**Electrochemistry-II**
40		Basic concept and Reversible electrodes
41		Nernst equation, referance electrode
42		Standard hydrogen electrode(Gas electrode)
43		Calomel electrode(metal insoluble salt electrode)
44		Types of electrochemical cell
45		Application of EMF
46		Electrochemical series and its significance
47		Potentiometric titration, concentration cell with and without transport
48		Relation between pH, pOH and pkw, Buffer solution and its type

49		Henderson's equation, salt hydrolysis- salt of strong acid and strong base
50		salt of strong acid and weak base
51		salt of weak acid and strong base
52		salt of weak acid and weak base
	5	**Surface chemistry**
53		Adsorption, absorption, types of adsorption
54		adsorption of gases and liquid in solid adsorbate
55		Freundlich and langmuir adslorption isotherm
56		Surface area and determination of surface area
57		Catalysis- Characteristics of catalyzed reactions, classification of catalysis
58		Application of catalysts, miscellaneous examples

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Department of Chemical Science

Lesson Plan - B.Sc. II Year (July 2020 - April 2021)

Subject - Chemistry Paper II (Inorganic Chemistry)

Teacher - Prof. Seema Shintre

Day/Lecture	Unit	Topic
	1	**Chemistry of elements of first transition series**
1		Characteristics properties of d-block elements- electronic configuration, metallic character
2		variable oxidation state, colour formation,atomic and ionic radii
3		complex formation, magnetic property
4		Catalytic property, formation of interstitial compounds
5		Binary compounds- oxides
6		sulphides and halides, carbides
7		complexes illustrating relative stability of their oxidation states, co-ordination number and geometry
	2	**Chemistry of elements of second and third transition series**
8		General introduction, characteristics- electronic configuration, atomic and ionic radius
9		Lanthenide contraction, variable oxidation states
10		Magnetic nature, term symbol, L-S coupling
11		magnetic succeptibility and its determination by Gouy method
12		Spectral nature, stereochemistry
	3	**Co-ordination compounds**
13		General introduction, Werner's co-ordination theory and its experimental verification
14		Nomenclature of co-ordination compounds
15		Sigdwick electronic concept of co-ordinate bond, Effective atomic number concept
16		Chelates, inner metallic complex
17		Isomerism in co-ordination compounds, structural isomerism
18		stereoisomerism- geometrical and optical isomerism
19		Valance bond theory of transition metal complex- octahedral complex
20		Tetrahedral and square planner complex
		Oxidation and Reduction
21		oxidation and Reduction, redox reaction, singal electrode potential
22		redox cycle, redox stability of water- Frost diagram
23		Latimer and Pourbaix diagrams.
24		Basic principle in the extraction of metals
	4	**(a) Chemistry of Lanthanide elements**
25		electronic structure, oxidation states
26		ionic radii and lanthanide contraction
27		complex formation occurrence and isolation
28		lanthanide compounds
		(b) Chemistry of Actinides
29		General features and chemistry of actinides
30		chemistry of Np, Pu and Am from U, Similarities between lanthanides and actinides
	5	**Acids and Bases**
31		Arrhenius concept, Bronsted-Lowry concept
32		Solvent system and Lewis concepts of acids and bases
33		Lux-Flood theory, Physical properties of a solvent
34		Types of solvents and their general characteristics
35		Reactions in non-aqueous solvents with reference to liquid NH_3
36		Reactions in non-aqueous solvents with reference to liquid SO_2

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Chemical Science

Lesson Plan - B.Sc. II Year (July 2020 - April 2021)

Subject - Chemistry Paper III (Organic Chemistry)

Teacher - Prof. Seema Shintre

Day/Lecture	Unit	Topic
	1	**Electromagnetic Spectrum: Absorption spectra**
1		basic concept of spectroscopy
2		Beer Lambert law
3		Molar absorptivity, Presentation and analysis of UV spectra
4		Types of electronic transitions
5		effect of conjugation, concept of chromophore and auxochrome
6		Bathochromic, hypsochromic, Hyperchromic and hypochromic shifts
7		UV spectra of conjugated enes and enones
8		IR absorption spectroscopy- Molecular vibrations
9		Hookes law, selection rules
10		intensity and position of IR bands
11		Measurement of IR spectrum, finger print region
12		Cheracteristic absorption of various functional groups
13		Interpretation of IR spectra of simple organic compounds
	2	**(a) Alcohols**
14		Classification and nomenclature
15		Monohydric alcohols- nomenclature, methods of formation
16		reduction of aldehydes,Ketones,carboxylic acids and esters
17		Hydrogen bonding, acidic nature
18		reaction of alcohols
19		Dihydric alcohols- nomenclature, methods of formation
20		chemical reactions of vicinal glycols
21		oxiidative cleavage and pinacol-pinacolone rearrangement
22		Trihydric alcohols- Nomenclature, methods of formation
23		chemical reactions of glycerols
24		**(b) Phenols**
25		Nomenclature, structure and bonding
26		Preparations of phenols, physical properties and acidic characters
27		comparative acidic strength of alcohols and phenols
28		resonance stablization of phenoxide ions, reactions of phenols
29		electrophilic aromatic substitutions, acylation and arboxylation
30		mechanism of Fries rearrangement, Claisen rearrangement
31		Gatermann synthesis, Hauben- Hoesche reaction
32		Lederer Manasse reaction and Reimer Teiman reaction
	3	**Aldehydes and Ketones**
33		Nomenclature, structure of the carbonyl group
34		synthesis of aldehydes and ketones - synthesis of aldehyde from acid chlorides
35		synthesis of aldehyde and ketone from 1,3 dithianes
36		synthesis of ketones from nitrilles and carboxylic acids
37		physical properties
38		mechanism of reactions- Aldol condensation and benzoin condensation
39		Perkin reaction and Knoevengel condensations
40		condensation with ammonia nd its derivatives
41		Wittig reaction and Mannich reaction
42		Use of acetals as protecting groups , oxidation of aldehydes

43		Baeyer-Villiger oxidation of ketones, cannizaro reaction
44		MPV, Clemmenson , Wolf Kischner reaction
45		$LiAlH_4$ and $NaBH_4$ reduction, Helogination
46		An introduction to alfa, beta unsaturated aldehyde and ketones
	4	**(a)Carboxylic acids**
47		Nomenclature ,structure and bonding
48		physical properties and acidity of carboxylic acids
49		Preparation and reactions of carboxylic acids
50		HVZ reaction, synthesis of acid chloride, esters and amides
51		reduction of carboxylic acids, Mechanism of decarboxylation
52		Methods and chemical reactions of halo acids, hydroxyl acid
53		Malic acid, tartaric acid , citric acids
54		Methods and chemical reactions of unsaturated monocarboxylic acids,
55		Dicarboxylic acids
		(b) Ether
56		Nomenclature of ether and methods of formation
57		physical properties and chemical reactions
58		Cleavage and auto oxidation, Zeisels method
	5	**Organic compounds of nitrogen**
59		Preparation of nitro-alkanes and nitro arene
60		Chemical reactions of nitro-alkanes
61		Mechanism of nucleophilic substitution in nitro-arenes
62		Reductions in neutral acidic and alkaline media
63		Haloarenes: Reactivity, Structure and nomenclature of amines
64		Physical properties, stereochemistry of amines
65		Seperation of mixture of primary,secondary and tertiary amines, basicity of amines
66		Amine salts as phase transfer catalyst, Preparation of alkyl and aryl amines
67		Gabrial Phthalimide reaction, Hoffmann-Bromamide reaction
68		Reaction of amines, electrophilic aromatic substitution in aryl amines
69		Reactions of amines with nitrous acid, Synthetic transformations of aryl diazonium salt
70		Azo coupling

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Chemical Sciences

Lesson Plan - B.Sc. II Year (July 2020 - April 2021)

Subject - Chemistry Practical

Teacher - Prof. Seema Sintre

Day/Lecture	Unit	Topic
		Inorganic Chemistry
1		Analysis of inorganic mixture containing five radicals with at least on interfering radicals
2		Determination of acetic acid in commercial vinager using NaOH
3		Redox Titration
4		Estimation of hardness of water by EDTA
		Physical Chemistry
5		Determination of transition temperature of given substance by thermometric method
6		To determine the enthalpy of neutralization of strong acid strong base
7		Verification of Beer's- Lambert law
8		To study the phase diagram of two component system by cooling curve method
		Organic Chemistry
9		Identification of an organic compound through the functional group analysis, determination
		of melting point and preparation of suitable derivatives.
10		Use of Paper chromatography/ Thin layer chromatography:
		Determination of Rf values, seperation and identification of organic compounds.
11	a	Seperation of green leaf pigments
12	b	Seperation of dyes

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Chemical Science

Lesson Plan - B.Sc. III Year (July 2020 - April 2021)

Subject - Chemistry Paper I

Teacher - Dr. Lal Kumar

Day/Lecture	Unit	Topic
1	**I**	**A. Elementary Quantum Mechanics:**
2	I	Black Body Radiation
3	I	Planck's radiation law
4	I	Photoelectric effect
5	I	Heat capacity of Solids
6	I	Bohr's Model of Hydrogen atom (no derivation) and its defects
7	I	Compton effect
8	I	de-Broglie hypothesis
9	I	The Heisenberg's uncertainty priciple
10	I	Sinusoidal wave equation
11	I	Hamiltonian Operator
12	I	Schrodinger wave equation and its importance
13	I	Physical interpretation of the wave function
14	I	Postulate of quantum mechanics
15	I	Particle in a one dimentional box
16	I	**B. Molecular orbital theory**
17	I	Basic ideas criteria for forming molecular orbital(MO) from A.O.
18	I	Construction of MO's by LCAO-H2 ion
19	I	Calculation of energy level from wave function
20	I	Physical picture of bonding and antibonnding wave functions
21	I	Concept of sigma, sigma star, pi, pi star calculation of coefficient of AO's used in these hybrid orbitals
22	I	Introduction to Valence bond model of H2 ion
23	I	Comparison of M.O. and V.B. models
24	**II**	**Spectroscopy**
25	II	Introduction of electromagnetic radiation
26	II	Region of the Spectrum
27	II	Basic features of different spectrometers
28	II	Statement of the Born-Oppenheimer Approximation
29	II	Degree of Freedom
30	II	**Rotational Spectrum**
31	II	Diatomic Molecules
32	II	Energy levels of a rigid rotator (Semi-classical principles)
33	II	Selection Rules

34	II	Spectral Intesities
35	II	Distribution using population distribution
36	II	Maxwell-Boltzmann Distribution
37	II	Determination of bond length
38	II	qualitative description of non-regid rotator
39	II	Isotopic effect
40	II	**Vibrational Spectrum**
41	II	Infra-red spectrum
42	II	Energy level of simple harmonic oscillator
43	II	Selection Rules
44	II	Pure Vibrational Spectrum
45	II	Spectral Intesities
46	II	Determination of force constant and bond energies
47	II	effect of an harmonic motion and
48	II	Isotop on the spectrum
49	II	Idea of vibrational frequencies of different functional groups
50	**III**	**Raman spectrum**
51	III	Concept of polarisabilities
52	III	Pure Rotational and Pure Vibrational Raman spectra of diatomic molecules
53	III	Selection Rules
54	III	Application to Raman Spectra
55	III	**Electronic Spectrum**
56	III	Concept of potential energy curves for bonding and antibonding molecular orbitals
57	III	Qualitative description of selection rules
58	III	Franck-condon principle
59	III	Qualitative description of sigma , pi, and n M.O. their energy levels and their Transition
60		**UV Spectroscopy**
61	III	Electronic Excitation
62	III	Elementary idea of instrument used
63	III	Application to Organic Molecules
64	**IV**	Woodward-Fieser Rule for determining lemda max of enes, polyenes and alfa, beta-unsaturated carbonyl compouds
65	IV	**Photochemistry**
66	IV	Interaction of radiation with matter
67	IV	difference between thermal and photochemical processes
68	IV	law of photochemistry
69	IV	Grothus-Drapper Law
70	IV	Stark-Einstein Law
71	IV	Jablonski Diagram depicting various processes occurring in the excited state

72	IV	Qualitative description of fluorescene
73	IV	Phosphorescence, Non-radioactive processes
74	IV	Internal conversion, Intersystem crossing
75	IV	Quantum Yield
76	IV	Photosensitised reaction energy transfer processes
77	IV	Simple examples
78	**V**	**Physical Properties and Molecular Structure**
79	V	Optical Activity
80	V	Polarisation (Clausius-Mossotti equation)
81	V	Orientation of dipoles in an electric field
82	V	Dipole moment, Induced dipole moments
83	V	Measurement of dipole moment
84	V	Temparature Method and Refractive method
85	V	Magnetic Properties
86	V	Paramagnetism, Diamagnetism and ferromagnetism

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Chemical Science

Lesson Plan - B.Sc. III Year (July 2020 - April 2021)

Subject - Chemistry Paper II

Teacher - Dr. Lal Kumar

Day/Lecture	Unit	Topic
1	**I**	**A. Hard and Soft Acids and Bases (HSAB)**
2	I	Introduction: Classification of Hard and soft acid-base
3	I	Hard and soft acid-base concept of pearson
4	I	Application of hard-soft acid base theory
5	I	Symbosis
6	I	Acid-base strength and hardeness and softness
7	I	Theoretical basis of hardness and softness
8	I	Electronic theory
9	I	Pi-bonding theory and Dragowayland theory
10	I	Electronegativity and hardness and softness
11	I	Limitation of hard soft acid-base concept
12	I	**B. Silicones and Phosphazenes**
13	I	Introduction: Silicones methods of preparation, Classification, properties and applications
14	I	Phosphazenes(Phosphonitrilic Chloride) Methods of preparation and properties
15	I	Structure of Triphosphazenes
16	I	Some other phosphazenes and uses of phosphazenes
17	**II**	**A. Metal Ligand Bonding in Transition Metal Complexes**
18	II	Introduction:limitation of valence bond theory
19	II	Crystal Field Theory
20	II	Crystal Field Splitting of d-orbitals, d-orbital splitting and stabilisation energy in octahedral, Tetrahedral and square planner complexes
21	II	Factor affecting the crystal field parameters
22	II	Applications of crystal field theory and limitation of crystal field theory
23	II	**B. Thermodynamic and Kinetic Aspects of Metal Complexes**
24	II	Introduction: Thermodynamic aspects of metal complexes
25	II	factor affecting thermodynamic stability of complexes
26	II	Kinetic aspects of metal complexes and factor affecting the rate of substitution reactions in square planner complexes
27	**III**	**Magnetic Properties of Transition Metal Complexes**
28	III	Introduction:Types of Magnetic behaviour

29	III	Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism
30	III	Origin and calculation of magnetism
31	III	Methods of determining magnetic susceptibility
32	III	Quincke's Curie and Nuclear magnetic resonance method
33	III	Magnetic moment:L-S coupling
34	III	determination of ground state term symbol
35	III	Correlation of mu and mu effect values
36	III	Orbital contribution to magnetic moments and
37	III	Application of Magnetic moment data for 3d-metal complexes
38	**IV**	**A. Electronic Spectra of Transition Metal Complex**
39	IV	Introduction: Type of electronic transition
40	IV	Selection rules for d-d trasitions
41	IV	spectroscopic ground state in complexes
42	IV	Spectrochemical Series, Orgal energy level diagram used in octahedral and tetrahedral complexes having d1 to d9 states
43	IV	Electronic Spectrum of [Ti(H2O)6]3+ complex ion
44	IV	**B. Organometallic Chemistry**
45	IV	Introduction:Nomenclature and Classification of Organometallic Compounds
46	IV	General Methods of preparation: Alkyl and aryl organometallic compounds of Lithium: Preparation, Properties, Bond Nature and application organometallic compound of Al, Hg, Sn, Ti
47	**V**	**A. Bio-Inorganic Chemistry**
48	V	Introduction:Essential and trace elements in biological processes
49	V	Biological function of the bio-elements
50	V	Availability of Bio-metals and bio-non-metals
51	V	Metalloporphyrins
52	V	Haemoglobin structure and biological function
53	V	Myoglobin-mechanism of oxygen transfer through haemoglobin and myoglobin
54	V	Relation between haemoglobin and myoglobin
55	V	Biological role of alkali and alkaline earth metal ions with special reference to Ca2+
56	V	Nitrogen Fixation
57	V	**B. Metal Nitrosyl Complex**
58	V	Nitrosyl agents, synthesis, structure Properties and bonding

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Department of Chemical Science

Lesson Plan - B.Sc. III Year (July 2020 - April 2021)

Subject - Chemistry Paper III

Teacher - Dr. Lal Kumar

Day/Lecture	Unit	Topic
1	**I**	**Nuclear Magnetic Resonance Spectroscopy**
2	I	Proton Magnetic Resonance Spectroscopy
3	I	Nuclear Shielding and Dis-shielding
4	I	Chemical Shift and Molecular Structure
5	I	Spin -spin coupling and coupling costant
6	I	Region of the signals
7	I	Explanation of PNMR spectra of simple organic molecules
8	I	eg ethanol, ethyl bromide, acetaldehyde, 1,1,2-tribromo ethane, ethylacetate, Toluene, and acetophenone
9	I	Application of UV, IR, and PNMR spectroscopy for simple organic compounds
10	**II**	**A. Organo-mettalic Compounds**
11	II	Organo-magnesium compounds: Grignard Reagent
12	II	Preparation, structure and chemical reactions
13	II	Organo-zinc compounds: preparation and chemical reactions
14	II	**B. Organo-sulphur compounds**: Nomenclature, Structural characteristics thiol, thio-ether, sulphonic acid, sulphonamide and sulphaguanidine method of preparation and chemical reactions
15	II	**C. Organic synthesis by enolates:**
16	II	Acidity of hydrogen
17	II	alkylation of diethyl malonate and ethyl acetoacetate
18	II	Synthesis of ethylacetoacetate
19	II	Claisen condensation
20	II	Keto-enol toutomerism form in ethylacetoacetate
21	II	Alkylation of 1,3-dithiane
22	II	Alkylation and acetylation of enamine
23	**III**	**A. Carbohydrates**
24	III	Classification and nomenclature
25	III	monosaccharides
26	III	Mechanism of Osazone formation
27	III	Inter conversion of glucose into fructose
28	III	Ascending and descending series in aldose
29	III	Configuration of monosaccharides
30	III	Stereo isomers of erythro and theo sugars
31	III	Conversion of glucose into mannose

32	III	Glycosides, determination of the size of the ring of monosachharides
33	III	Ring structure of D(+) glucose
34	III	Mechanism of mutarotation
35	III	Structure of ribose and deoxyribose
36	III	Disaccharides introductory idea of maltose, sucrose, and lactose (excluding structure)
37	III	Polysaccharides introductory idea of starch and cellulose(Excluding Structure)
38	III	**B. Fat, Oil and Detergents:**
39	III	Natural fat, edible and industrial oil of plant origin
40	III	Normal fatty acids, glycerides
41	III	Hydrogenation of unsaturated oil
42	III	Sponification value, iodine value and acid value
43	III	Synthetic Detergents:Alkyl and aryl sulphonate
44	**IV**	**A. Amino Acids, Peptide, Protein and Nucleic Acid**
45	IV	Classification of Amino Acid
46	IV	Structure stereo chemistry
47	IV	Acid base behavior isoelectric point and electrophoresis
48	IV	Preparation and chemical reaction of alpha amino acids
49	IV	Nomenclature and structure of peptide and proteins
50	IV	Classification of proteins,
51	IV	Determination of peptide structure
52	IV	end group analysis
53	IV	Selective hydrolysis of peptides
54	IV	Peptide synthesis, solid phase peptide synthesis
55	IV	Structure of peptide and proteins
56	IV	level of proteins structure
57	IV	denaturation of proteins
58	IV	Nucleic Acids: constitution of nucleic acid
59	IV	Ribonucleoside and ribonucleotide
60	IV	Double helix stucture of DNA
61	**IV**	**B. Synthetic Dyes:**
62	IV	Colour and constitution (electronic concept)
63	IV	Classification of dyes
64	IV	Methyl Orange
65	IV	Congored
66	IV	Malachite Green
67	IV	Crystal Violet
68	IV	Phenolphthalein
69	IV	Fluoroscein
70	IV	Alizarine and Indigo dyes
71	**V**	**Heterocyclic compounds**

72	V	Introduction, Classification nomenclature, Aromatic Character and molecular orbital picture of Pyrrole, Furan, Thiophene and Pyridine
73	V	Furan:Preparation, Properties, Structure
74	V	Thiophene:Preparation, Properties, Thiophene as a Resonance hybrid
75	V	Pyrrole: Preparation, Properties, Orbital Structure, Orientation in pyrrole in electrophilic substitution reaction
76	V	Six atom heterocyclic compounds:Pyridine, synthesis, orientation in pyridine substitution reactions, properties, uses, structure
77	V	Condensed ring systems:Indole, Synthesis, Properties amd Reactions
78	V	Quinoline:Preparation, Properties, uses and constitution of quinoline
79	V	Isoquinoline:Preparation, Properties, uses and constitution of Isoquinoline, Exercises

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Lesson Plan - B.Sc. III Year (July 2020 - April 2021)

Subject - Chemistry Practical

Teacher - Dr. Lal Kumar

Day/Lecture	Unit	Topic
1	**I**	**Inorganic Chemistry**
2	I	**A. Gravimetric Analysis:**
3	I	Barium as Barium Sulphate
4	I	Copper as cuprous-thiocynate
5	I	**B. Complex Compound Preparation**
6	I	i) To prepare and submit Potassium Chlorochromate(IV)
7	I	ii) To prepare and submit Tetra amine copper (II) sulphate monohydrate
8	I	iii) To prepare and submit Hexaaminenickel(II)chloride
9	I	**C. Effluent water Analysis**:To identify cation and anion in given different water samples.
10	I	**D. Water Analysis**:To determine dissolve oxygen in given water sample in ppm
11	**II**	**Physical Chemistry**
12	II	To determine the velocity constant(specific reaction rate) of hydrolysis of methyl acetate/ ethyl acetate catalysed by hydrogen ions at room temparature.
13	II	To determine the partition coefficient of iodine between carbon tetra chloride and water.
14	II	To find out the complex by Job's methods
15	II	pH-titration
16	II	Conductometric titration
17	**III**	**Organic Chemistry**
18	III	To separate and identify organic mixture having two solids organic compounds and also prepare their derivatives
19	III	Preparation
20	III	A. Acetylation
21	III	B. Benzoylation
22	III	C. m-dinitrobenzene
23	III	D. Picric Acid