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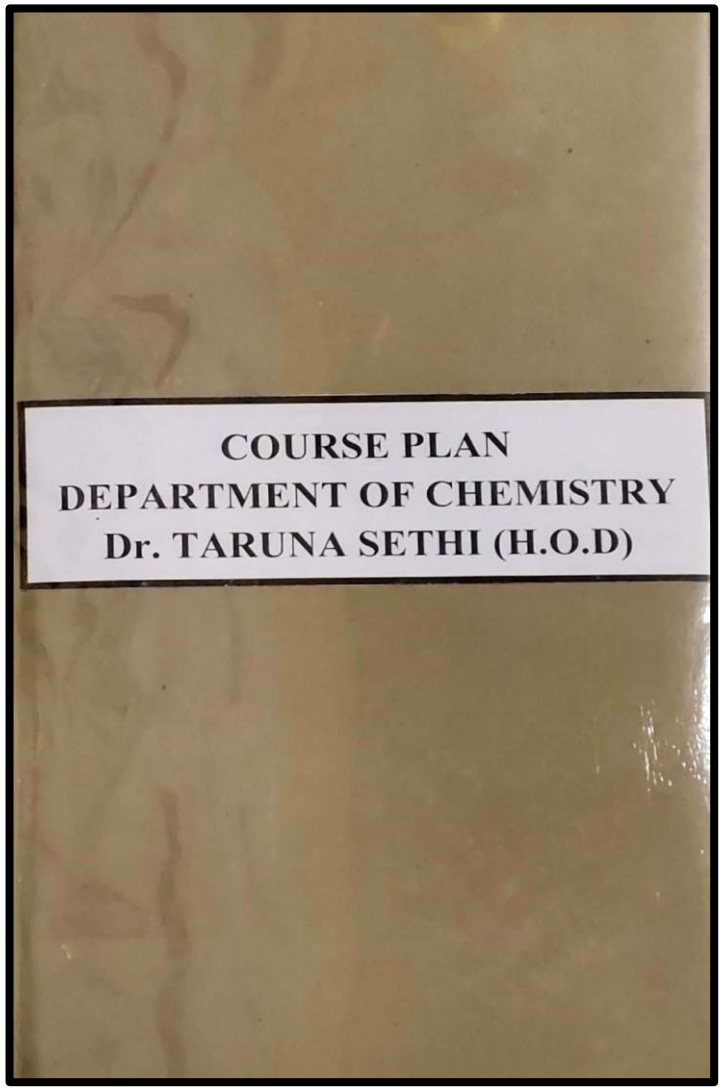

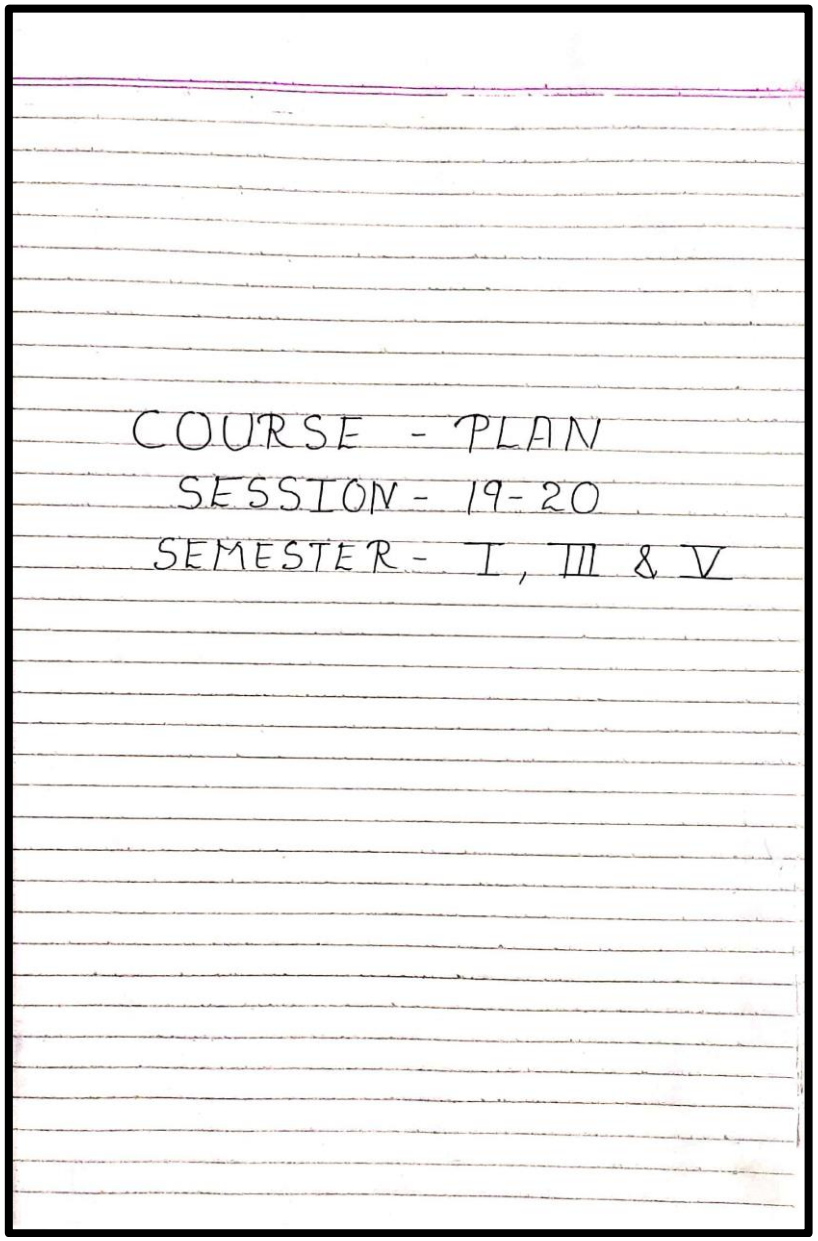
COURSE - PLAN
SESSION - 19-20
SEMESTER - I, III & V

B.Sc. III (SEMESTER V)

INORGANIC CHEMISTRY (PAPER I) (CHE-501)

Max. Marks : 75 (50Ext; 25 Int) Min. Marks: 30(20 Ext;10 Int) Credit: 03

COURSE PLAN

SEMV Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM I JULY	**UNIT I** **Metal-ligand Bonding in Transition Metal Complexes** An elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields, Comparison of CFSE for octahedral and tetrahedral complexes.	Metal-ligand Bonding in Transition Metal Complexes	PPT, Flow charts	Summarize Metal ligand bonding and various thermodynamic and kinetic aspects of transition metal complexes.	*Based* - Define Thermodynamic Stability - List any two roles of Ca in Body? *Understanding Based* - Compare paramagnetic and diamagnetic substances. - Give relationship between stepwise and overall formation constant. *Higher Order Thinking Skills*	Knowledge--40 Understanding-40 Higher Order-20
	Thermodynamic and Kinetic Aspect of Metal Complexes A brief outline of thermodynamic stability of metal complexes and factors	Stability of metal complexes, Trans effect	Group discussions			

	affecting the stability, Substitution reactions in square planar Trans effect, Trans effect series, theories of Trans effect, mechanism of substitution reactions, Factors affecting the rate of substitution reactions in square planar complexes.				*Based* - Predict Structure and bonding in $(NPCl_2)_3$ - Explain the Pearson's HSAB Concept.	
AUGUST	**UNIT II** **Magnetic Properties of Transition Metal Complexes** Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.	Magnetic Properties of Transition Metal Complexes	Flipped classrooms, Quiz	Explain magnetic properties and electronic spectra of transition metal complexes.		
	Electronic Spectra of Transition Metal Complexes Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states,	Electronic Spectra of Transition Metal Complexes	Diagrams, Charts			

	discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.					
SEPTEMBER-OCTOBER	**UNIT III** **Basics of Bioinorganic Chemistry** Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Role of metal ions present in biological systems with special reference to Na^+, K^+, Mg^{2+} and Ca^{2+} ions: Na/K pump; Nitrogen fixation.	Role of metal ions in Biological Processes	PPT, Quiz	Predict hard and soft acid base character of various compounds.		
	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, applications of HSAB concept.	Hard and soft acid base Character	Charts, Group discussions			
	Silicones and Phosphazenes	Preparation and properties of Silicones	Quiz, Diagrams			

	Silicones and phosphazenes as examples of Inorganic polymers, preparation, Properties and applications of Silicones and Phossphazenes, nature of bonding in triphosphazenes	and Phosphazenes				

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B.Sc. III (SEMESTER V)

PRACTICALS (CHE-503)

Max. Marks: 50(40Ext; 10 Int) Min Marks: 20(16 Ext;4 Int) Credit: 02

COURSE PLAN

SEM Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEMV JULY	**(A) Instrumentation** • **Colorimetry** Job's method and Mole-ratio method • Adulteration- Food stuffs. • Effluent analysis, water analysis. • Solvent Extraction: Separation and estimation of Mg(II) and Fe(II) • Ion Exchange Method: Separation and estimation of	Use of various instruments like colorimeter.	Exercises with Use of different Apparatus, instruments like pH meter	Understand the practical applications of various aspects of chemistry	*Knowledge Based* Practical File Work *Understanding Based* To detect the components of the organic mixture *Higher Order Thinking Skills Based* Viva Voce	Knowledge--30 Understanding-50 Higher Order-20

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	Synthesis • Sodium trioxalato ferrate (III), $Na_3[Fe(C_2O_4)_3]$ • Ni-DMG complex,$[Ni(DMG)_2]$ • Copper tetrammine complex $[Cu(NH_3)_4]SO_4$. • cis-and trans-bisoxalato diaqua chromate (III) ion.	Methods of Synthesis of various inorganic compounds	Demonstration of the exercise, Laboratory Experiments			
	Organic Qualitative Analysis Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of Suitable Derivatives	Detection of organic compounds in binary mixture	Demonstration of the exercises, Flow Chart, Laboratory Experiments			

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SOPHIA GIRLS' COLLEGE, AJMER (*AUTONOMOUS*)
M.Sc. CHEMISTRY (PREVIOUS)
SEMESTER I

INORGANIC CHEMISTRY (CHEM-101)

MAX. MARKS: 100 (70 EXT; 30 INT) **MIN. MARKS: 40 (28 EXT;12 INT)**

COURSE PLAN

SEM/ Month	Unit/Topic	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM I JULY	**Unit - I** VSEPR, Walsh diagrams of tri atomic molecules, dπ-pπ bonds, bonds, Bent's rule, simple reactions of covalently bonded molecules	Stereochemistry and bonding in main group compounds	PPT, 3-D Models	Predict stereochemistry and bonding in main group compounds	*Knowledge Based* -What is VSEPR theory? -Define archaeroboranes *Understanding Based* -Compare the properties of	Knowledge-25 Understanding-45 Higher Order-30

	Higher boranes, carboranes, metalloboranes and metallocarboranes	Metals Clusters	PPT, Diagrams		boranes and carboranes. - Classify Labile and Inert Complexes. *Higher Order Thinking Skills Based* - Explain dπ-pπ bonding. - Elaborate SN^1CB mechanism.	
AUGUST	**Unit - II** Energy profile of reaction, reactivity of metal complexes, inert and labile , kinetic applications of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, base hydrolysis, conjugate base mechanism	Fundamentals of Transition Metal Complexes	PPT, Match the following	Assess the chemical behaviour of transition metal complexes.		
SEPTEMBER-OCTOBER	**UNIT - III** Anation reaction, reactions without metal ligand bond cleavage.Substitution reactions in square planar	Reaction Mechanism of Transition Metal Complexes	3-D Models, Match the following	Summarize the reaction mechanism of transition metal complexes.		

	complexes, the trans effect, mechanism of the substitution reaction, Redox reaction, electron transfer reactions, outer & inner sphere type reactions, cross reactions and Marcus-Hush theory.					

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SOPHIA GIRLS' COLLEGE, AJMER (*AUTONOMOUS*)
M.SC CHEMISTRY (PREVIOUS)
Practicals (CHEM-105)

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III JULY	**INORGANIC PREPARATIONS** • Tris(thiourea)copper (II)sulphate. • Cis –Potassium Diaquatrioxalatochromate(III). • SodiumDiamminetetrathiocynatochromate(III). • Tris(acetylacetonato)manganese(II). • Potassium Trioxalatoferrate(III). • Purssian Blue. • Hexamminecobalt(III) • Hexanitro-N-cobaltate(III). • Vanadyl acetylacetonate • Dichloridobis(pyridine)cobalt(II). • Hexamminenickle(II) chloride. • Bis(dimethylglyoximato)nickel (II). • Tetramminecopper(II) sulphate.	Methods of Synthesis of various inorganic compounds	Demonstration of the exercise	Understand the practical applications of various aspects of chemistry	*Knowledge Based* - Practical File Work *Understanding Based* To prepare Cis –Potassium Diaquatrioxalatochromate(III). *Higher Order Thinking Skills Based* - Viva Voce	Knowledge--20 Understanding-40 Higher Order-40

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SOPHIA GIRLS' COLLEGE, AJMER (*AUTONOMOUS*)
M.SC CHEMISTRY (FINAL)
SEMESTER III (M.Sc. F)

BIOINORGANIC CHEMISTRY (CHEM-304)

MAX MARKS: 100 (70EXT; 30 INT) **MIN. MARKS: 40 (28 EXT;12 INT)**

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III JULY	**Unit-I** Role of bulk and trace metals ions in biological processes with special reference to Ca, Mg, Mn, Fe, Co, Na and K. Na^+/K^+ Pump.	Role of metal ions in biological system	Diagrams, PPT, Charts.	Review of bioenergetics and nitrogen fixation.	*Knowledge Based* - Define Endergonic reactions. - Draw the structure of carbonic anhydrase. *Understanding Based* - Discuss the structural features	Knowledge--25 Understanding-45 Higher Order-30
	Standard free energy change in biochemical reactions, exergonic, endergonic, Hydrolysis of ATP, synthesis of ATP from ADP.	Bioenergetics	Models, Quiz			

	Biological nitrogen fixation and its mechanism, nitrogenase, chemical nitrogen fixation and other nitrogenase model systems.	Biological and chemical nitrogen fixation	PPT, Flow charts		of catalase enzyme. - Compare the structure and reactivity of hemoglobin and myoglobin. *Higher Order Thinking Skills Based* - Elaborate the structure and mechanism of oxidation of a substrate by Cytochrome P-450. - Explain in detail biological and chemical nitrogen fixation.	
AUGUST	**Unit-II** Zinc enzymes- carboxypeptidase A and carbonic anhydrase. Iron enzyme- oxygenases, cytochrome P-450, catalase and peroxidase. Copper enzyme- superoxide dismutase. Molybdenum enzyme- xanthine oxidase. Vitamin B_{12}.	Metalloenzymes and their role in biological systems	Quiz, Diagrams, Models	Illustrate metalloenzymes and metals in medicine.		
	Metals deficiency and disease, toxic effects of metals, metals used for diagnosis and chemotherapy with particular reference to anticancer drugs based on Pt.	Metals In Medicine	Demonstration, PPT, charts			
SEPTEMBER-OCTOBER	**Unit-III** Oxygen transport and oxygen uptake proteins. Haemoglobin (Hb) and Myoglobin (Mb) in oxygen transport mechanism.	Haemoglobin and Myoglobin : Structure, functions, mechanism	PPT, Flow charts, Diagrams	Analyse haemoglobin and myoglobin in oxygen transport mechanism.		

	Structural feature of Heme group in Hb and Mb. Functions of Hb and Mb. Characteristics of oxygen binding interactions with Hb and Mb.					

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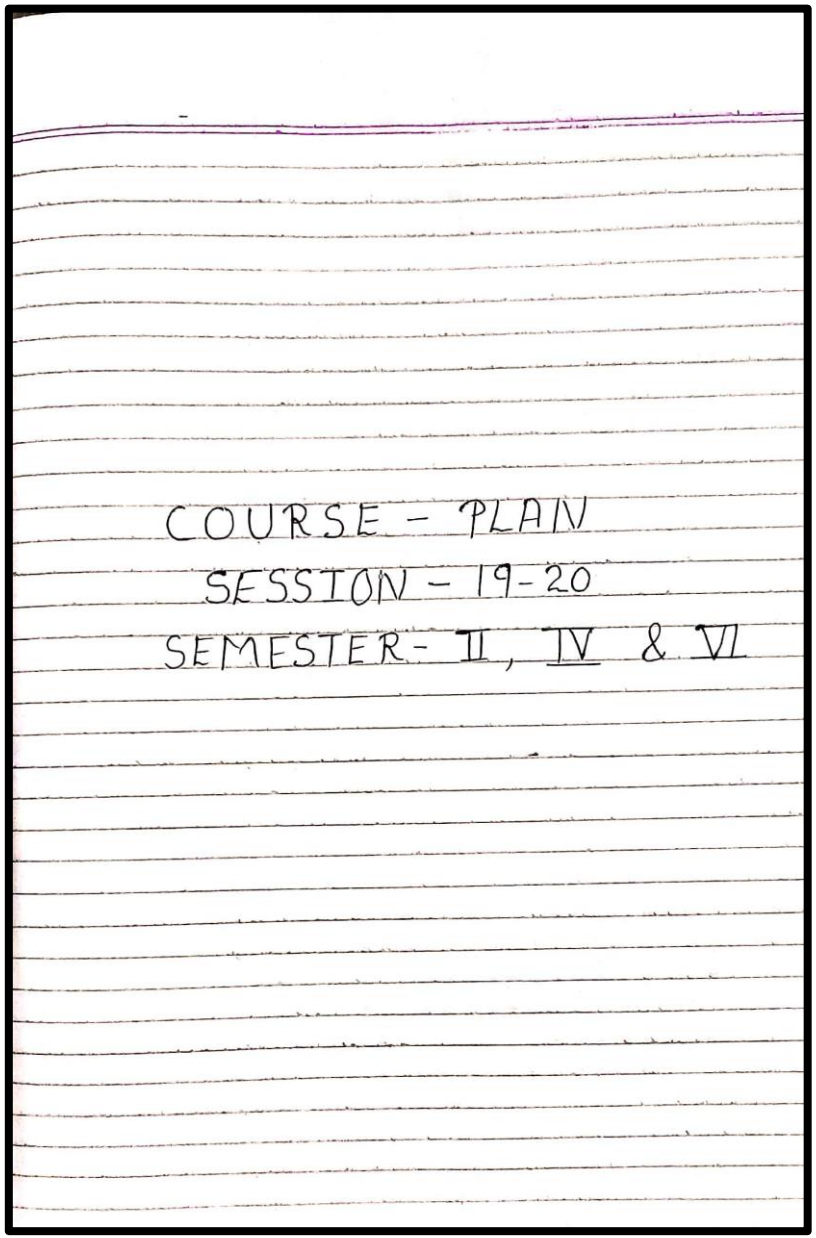
COURSE - PLAN
SESSION - 19-20
SEMESTER - II, IV & VI

B.Sc. III (SEMESTER VI)

PHYSICAL CHEMISTRY (PAPER I) (CHE-601)

Max. Marks: 75 (50Ext; 25 Int) Min. Marks: 30 (20 Ext; 10 Int) Credit: 03

COURSE PLAN

SEM VI Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM VI DECEMBER-JANUARY	**UNIT I** **Elementary Quantum Mechanics** Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. de Broglie hypothesis, 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.	Various aspects of Quantum Mechanics	PPT, Flow charts	Explain Quantum mechanics and Photochemistry	*Knowledge Based* - Define Black Body Radiation. - Write Franck Condon principle. *Understanding Based* - Derive Schrodinger Wave Equation. - Differentiate Stoke and Anti-stoke lines. *Higher Order Thinking Skills Based* - Describe	Knowledge--40 Understanding-40 Higher Order-20

	Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of Photochemistry : Grothus - Drapper law, Stark-Einstein law, Jablonski diagram Quantum efficiency and reasons for high and low quantum yields, photosensitized reactions- energy transfer processes.	Qualitative description of Photochemistry and Photosensitized reactions	Group discussions, PPT		Jablonski Diagram. - Explain kinetics of Enzyme Catalysis.	
FEBRUARY	**UNIT II** **Spectroscopy** Spectroscopy and its importance in Chemistry, difference between atomic and molecular spectroscopy, Absorption and emission spectroscopy, electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.	Various spectroscopic techniques	Flipped classrooms, Quiz	Summarize the principles of various spectroscopic techniques.		

	Rotational Spectrum Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, Maxwell-Boltzmann distribution, determination of bond length, qualitative description of non-rigid rotor, isotope effect.	Qualitative description of rotational spectroscopy	Diagrams, Charts			
	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.	Infrared and Raman spectrum	Quiz, group discussions			

	Electronic Spectrum Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle. Qualitative description of σ, Π and n M.O., their energy levels and the respective transitions.	Concept of Electronic spectrum	Models, diagrams			
MARCH-APRIL	**UNIT III Chemical Kinetics and Catalysis** Chemical kinetics and its scope, rate of reaction, factors influencing the rate of a reaction. Determination of the order of reaction, Radioactive decay as a first order phenomenon. Experimental methods of chemical kinetics, Theories of chemical kinetics-effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory, Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Complex reaction kinetics, parallel reaction, reversible reaction and conjugative	Kinetics of Enzyme catalyzed reactions	PPT, Quiz	Assess the kinetics of various chemical reactions		

	reactions Catalysis, Characteristics, classification, miscellaneous examples, Kinetics of enzyme catalyzed reactions – Michaelis-Menten equation					

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B.Sc. III (SEMESTER VI)

PRACTICALS (CHE-603)

Max. Marks: 50(40Ext; 10 Int) Min. Marks: 20(16 Ext; 4Int) Credit: 02

COURSE PLAN

SEM Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM VI DECEMBER - JANUARY	**A) Laboratory Techniques** **Column Chromatography** (i) Separation of fluorescene and methylene blue (ii) Separation of leaf pigments from spinach leaves (iii) Resolution of racemic mixture of (±) mandelic acid	Principle, phenomenon and applications of Column Chromatography	Exercises with Use of column chromatography	Understand the practical applications of various aspects of chemistry.	*Knowledge Based* Practical File Work *Understanding Based* To synthesize various organic compounds. *Higher Order Thinking Skills Based* Viva Voce	Knowledge--30 Understanding-50 Higher Order-20
FEBRUARY	**(B) Synthesis of organic compounds** (i) m-dinitrobenzene (ii) p-nitroacetanilide (iii) Methyl orange (iv) Methyl red	Methods of Synthesis of various organic compounds	Demonstration of the exercise			

MARCH-APRIL	**(C) PHYSICAL CHEMISTRY** (i) To determine the strength of the given acid conductometrically using standard alkali solution. (ii) To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.	Verification of Beer-Lambert Law	Demonstration of the exercises			

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SOPHIA GIRLS' COLLEGE, AJMER *(AUTONOMOUS)*
M.Sc. CHEMISTRY (PREVIOUS)
SEMESTER II

COORDINATION CHEMISTRY(CHEM-201)

MAX. MARKS: 100 (70 EXT; 30 INT) **MIN. MARKS: 40 (28 EXT;12 INT)**

COURSE PLAN

SEM/ Month	Unit/Topic	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM II DECEMBER -JANUARY	**Unit – I** **Metal-Ligand Equilibria in Solution** Stepwise and overall formation constants 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-metry and spectrophotometry.	Factors affecting the stability of metal complexes ; nature of metal ion and ligand	Diagrams, Tables, Chart.	Analyse the aspects of metal-ligand equilibria in solution and metal-ligand bonding.	*Knowledge Based* - Define thermodynamic Stability. - Write any two limitations of Crystal field theory. *Understanding Based* - Give relation between overall	Knowledge-25 Understanding-45 Higher Order-30

	Metal Ligand Bonding Limitation of crystal field theory, molecular orbital theory- σ and π–bonding in octahedral, tetrahedral and square planar complexes.		PPT, Diagrams		stability constant β and stepwise stability constant. - Write a note on Spin Crossover.	
FEBRUARY	**Unit - II** Spectroscopic ground state, Selection rules for electronic spectra – Laporte and Spin selection rule, relaxation in rules, luminescence, Orgel diagrams for transition metal complexes (d_1-d_9 States). Charge transfer spectra, anomalous magnetic moments, magnetic exchange coupling and spin crossover.	Electronic Spectra and Magnetic Properties of Transition Metal Complexes	PPT, Chart	Summarize various concepts of electronic spectra and magnetic properties of transition metal complexes.	*Higher Order Thinking Skills Based* - Draw the Orgel energy level diagram for d^2 electronic configuration in octahedral complexes. -Discuss important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes.	
MARCH-APRIL	**UNIT - III** **Metal π-Complexes:** Metal carbonyls, structure	Structure and Bonding of Metal π-	3-D Models, Match the	Review various metal π-complexes.		

	and bonding. Vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.	Complexes	following			

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SOPHIA GIRLS' COLLEGE, AJMER (*AUTONOMOUS*)
M.Sc. CHEMISTRY (FINAL)
GROUP-A INORGANIC CHEMISTRY
SEMESTER IV

ORGANOMETALLIC CHEMISTRY- CHEM-401(A)

MAX MARKS: 100 (70EXT; 30 INT) MIN. MARKS: 40 (28 EXT;12 INT)

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM IV DECEMBER-JANUARY	Unit-I **An Introduction to Organometallic Compounds** Introduction, Classification and Nomenclature of Organometallic Compounds, Bonding: Stable electron Configuration, Electron	Introduction to Organometallic Compounds	Diagrams, PPT, Charts.	Summarize the basic concepts of organo transition metal complexes.	*Knowledge Based* - What are sandwich compounds? - Define turn over frequency. *Understanding Based*	Knowledge--25 Understanding-45 Higher Order-30

	Count Preference, Electron Counting and Oxidation states, Reaction of Organometallic Compounds- Ligand Subsituition, Oxidative addition and Reductive elimination, σ bond metathesis, 1, 1-Migratory insertion, 1, 2- insertions and β hydride elimination and Cyclometallations. Concept of Isolability and Isolobal analogies.				- Describe σ bond metathesis with one example. - Discuss the energetics of catalytic cycle. *Higher Order Thinking Skills Based* - Elaborate Reductive elimination with one example. - Elaborate Wacker`s process of synthesis of acetaldehyde.	
FEBRUARY	**Unit-III** **Application of Organometallic Compounds as homogenous Catalysts** 1. Hydrogenation of Alkene 2. Hydroformation 3. Wacker process 4. Alkene Metathesis 5. Pd catalysed C-C Bond forming reactions 6. Methanol Carbonylation-ethanoic acid synthesis	Catalytic aspects of Organometallic compounds	Diagrams, PPT Diagrams Flipped Classrooms	Illustrate application of organometallic compounds in homogenous catalysis.		

MARCH-APRIL	**Unit-II** **Organometallic compounds of Transition metals** Preparation, Properties, Nature of Bonding and Structural features of σ bonded Transition metal complexes and Complexes with unsaturated organic molecules alkenes, alkynes, allyl and diene.	Preparation , properties and reactions of organotransition metal complexes	PPT, Flow charts, Demonstration	Elaborate the chemistry of organo transition metal complexes.		

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M. SC. CHEMISTRY SEMESTER - IV

SUPRAMOLECULAR CHEMISTRY - CHEM- 402 (A)

	Supramolecular assemblies- Introduction, Supramolecular solid materials, molecular recognition at surfaces, molecular and supramolecular morphogenesis.	Association of Supramolecular Species to form Assemblies	Flow Charts, PPT			
MARCH-APRIL	**Unit-III** **Supra molecular photochemistry-** Light conversion and energy transfer devices, photosensitive molecular receptors, photinduced electron transfer in photoactive devices, photoinduced reactions in supramolecular devices, Non linear optical properties of supramolecular species, Supramolecular effects in photochemical hole burning.	Use of Supermolecules in Light Conversion Devices	PPT, Diagrams, Demonstration.	Elaborate about various supramolecular devices.		
	Molecular and Supra molecular electronic and ionic devices, switching devices and signals	Use of Supramolecular Species in various devices	Flow Charts, Flipped Classrooms			

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