DEPARTMENT OF CHEMISTRY
FACULTY OF ENGINEERING AND TECHNOLOGY
SRMIST
LESSON PLAN

ACADEMIC YEAR:
SEMESTER:
TOTAL HOURS: L - 45 hours +T-15 = 60Hrs

Course Code	18CYB101J	**Course Name**	Chemistry	**Course Category**	*BS*	*Basic Sciences*	L	T	P	C
							3	1	2	5

Module	Lecture	SLO	Topic	Detailed Lesson Plan
1	S-1	SLO-1	Schrodinger equation-introduction	Necessity of wave theory, Heisenberg uncertainty principle
		SLO-2	Schrodinger equation-Derivation	Derivation of Schrodinger equation(Time independent)
	S-2	SLO-1	Particle in a box solutions	Derivation of complete wave equation and solving for energy
		SLO-2	Applications for conjugated molecules	Derivation of complete wave equation and solving for energy- continuation of the above.
	S-3	SLO-1	Forms of the hydrogen atom wave functions	Radial wave function of H-atom(Radial part and radial probability)
		SLO-2	plots of these functions to explore their spatial variations	Angular wave function of H-atom
	S-4	**SLO-1** **SLO-2**	**Tutorial – significance of wave function in Schrodinger equation, Four Quantum numbers**	
	S-7	SLO-1	Molecular orbitals of diatomic molecules-Homonuclear	Molecular Orbital Theory - Introduction - LCAO method - Equations for atomic and molecular orbitals
		SLO-2	Heteronuclear diatomic molecules	*s-s* and *s-p* combinations of orbital (orbital diagrams)
	S-8	SLO-1	Equations for atomic orbitals	*p-p* combinations of orbital (orbital diagrams)
		SLO-2	Equations for molecular orbitals	Rules for LCAO - Energy level diagrams of diatomic molecules
	S-9	SLO-1	Energy level diagrams of diatomic-introduction	Examples for Homo-nuclear Diatomic molecules –H_2
		SLO-2	Energy level diagrams of diatomic-explanation	Example for Hetero-nuclear Diatomic molecules - CO
	S-10	**SLO-1** **SLO-2**	**Tutorial- Energy level diagram discussion on other examples of Homo/ Hetero-nuclear Diatomic molecules**	
	S-13	SLO-1	π-molecular orbitals of butadiene	Structure and orbital picture of butadiene
		SLO-2	π-molecular orbitals of benzene	Structure and orbital picture of benzene
	S-14	SLO-1	Aromaticity-Introduction	Rules for aromaticity-Huckel's rule
		SLO-2	Aromaticity-explanation	Aromatic/anti-aromatic/non-aromatic compounds- definition with an example only.
	S-15	SLO-1	Crystal field theory-Introduction	Crystal field theory – Introduction, Salient features of crystal field theory

		SLO-2	Crystal field theory- Introduction	Octahedral complex- splitting of *d* –orbitals- CFSE
	S-16	**SLO-1** **SLO-2**	**Tutorial-Calculation of CFSE for few Octahedral complexes**	
2	S-1	SLO-1	Crystal field theory- Explanation	Spectrochemical series
		SLO-2	Crystal field theory- Explanation	high spin and low spin complex – CFSE
	S-2	SLO-1	Energy level diagrams for transition metal ions	Tetrahedral complex - splitting of *d* –orbitals- CFSE
		SLO-2	Energy level diagrams for transition metal ions	High spin complex - CFSE
	S-3	SLO-1	Magnetic properties of transition compounds	Magnetism – introduction, Calculation of magnetic moment for octahedral complex
		SLO-2	Magnetic properties of transition compounds	Calculation of magnetic moment for tetrahedral complex
	S-4	**SLO-1** **SLO-2**	**Tutorial- Calculation of CFSE for few Tetrahedral complexes**	
	S-7	SLO-1	Principles of spectroscopy- Introduction	General introduction of spectroscopy- Properties of electromagnetic radiation,
		SLO-2	Principles of spectroscopy- Explanation	General introduction of spectroscopy- (continuation of the above) Regions of electromagnetic radiation.
	S-8	SLO-1	Selection rules-Introduction	Rotational spectroscopy-Introduction, (molecular dipole and rotation of molecules), selection rule only.
		SLO-2	Selection rules- Explanation	Vibrational spectroscopy- Introduction (Hooke's law, Condition for IR active), Selection rule only.
	S-9	SLO-1	Electronic spectroscopy – Introduction	Electronic spectroscopy- theory, Laporte and Spin rule
		SLO-2	Electronic spectroscopy- Explanation	Electronic spectroscopy of H-atom
	S-10	**SLO-1** **SLO-2**	**Tutorial- Exercises on properties of EMR (wavelength, frequency and wave number)**	
	S-13	SLO-1	Rotational spectroscopy of diatomic molecules.	Explanation on Rotational spectra of rigid diatomic molecules.
		SLO-2	Rotational spectroscopy of diatomic molecules.	Rotational spectra of rigid diatomic molecules - Continuation of above.
	S-14	SLO-1	Vibrational spectroscopy of diatomic molecules.	Explanation on Vibrational spectra of diatomic molecules
		SLO-2	Applications of vibrational and rotational spectroscopy of diatomic molecule	Explanation on Vibrational - Rotational spectra of diatomic molecule.
	S-15	SLO-1	Nuclear magnetic resonance – Introduction	Theory of NMR- Nuclear spin and the splitting of energy levels in a magnetic field.
		SLO-2	Nuclear magnetic resonance – Explanation	Chemical shift - definition , explanation with an example -Ethanol
	S-16	**SLO-1** **SLO-2**	**Tutorial- General applications of spectroscopy**	
3	S-1	SLO-1	surface characterization techniques – XPS – Introduction	XPS-Principle

		SLO-2	surface characterization techniques – XPS – Explanation	Instrumentation-Block diagram and components, Application
	S-2	SLO-1	Diffraction and scattering of solids	X-Ray diffraction and crystal structure- Bragg's law
		SLO-2	Explanation	Miller indices, inter-plane spacing's in lattices- definition with an example for each (only)
	S-3	SLO-1	Ionic, dipolar interactions	Intermolecular forces- Ionic, dipolar interactions (Define & explain)
		SLO-2	Van der Waals interactions	Van der Waals interactions (Define & explain)
	S-4	**SLO-1**	**Tutorial- General applications of XRD and XPS**	
		SLO-2	**Tutorial- Exercises on Miller indices**	
	S-7	SLO-1	Equations of state of real gases	Equations of state of real gases-Modified Vander Waals equation, Clausius equation, (No derivation)
		SLO-2	critical phenomena	Critical Temperature, Pressure, Volume (Definition)
	S-8	SLO-1	Effective nuclear charge, penetration of orbitals	Periodic table, Effective nuclear charge, penetration of orbitals (Slater's rule-formula only)
		SLO-2	variations of s, p, d and f orbital energies of atoms in the periodic table	variations in the periods and groups
	S-9	SLO-1	Electronic configurations, atomic and ionic sizes	Electronic configurations,
		SLO-2	Electronic configurations, atomic and ionic sizes	atomic and ionic sizes across the periods and groups
	S-10	**SLO-1**	**Tutorial- Discussion on Modern periodic Table**	
		SLO-2	**Tutorial- Problems on calculation of Z_{eff}**	
	S-13	SLO-1	ionization energies, electron affinity and electronegativity,	ionization energies – definition and trends across the periods and groups
		SLO-2	ionization energies, electron affinity and electronegativity,	electron affinity and electronegativity – definition and trends across the periods and groups
	S-14	SLO-1	Polarizability, oxidation states	Polarizability – Explanation based on Fajans' Rule and Oxidation state of ions
		SLO-2	Polarizability, oxidation states	Polarizability – Explanation based on Fajans' Rule and Oxidation state of ions – continuation of the above.
	S-15	SLO-1	Coordination numbers and geometries	Coordination numbers and geometries with examples
		SLO-2	Coordination numbers and geometries	Coordination numbers and geometries with examples
	S-16	**SLO-1**	**Tutorial- Exercises on calculating Oxidation state**	
		SLO-2		
4	S-1	SLO-1	Hard soft acids and bases	HSAB – Types
		SLO-2	Hard soft acids and bases	Examples
	S-2	SLO-1	Thermodynamic functions: energy	Internal energy, Helmholtz free energy, Enthalpy, (Definition, expression & explanation)
		SLO-2	Entropy and free energy	Gibbs's free energy, Entropy (Definition, expression & explanation)

	S-3	SLO-1	Estimation of entropy	Estimation of entropy and free energy(Gibb's – Helmholtz equation of free energy and its application)
		SLO-2	Estimation of free energies.	(Gibb's – Helmholtz equation of free energy and its application)-Continuation of the above
	S-4	**SLO-1** **SLO-2**	**Tutorial- Discussions on Basic terms (System, Surroundings, Homogeneous, Heterogeneous, open, closed etc.,), Laws of Thermodynamics**	
	S-7	SLO-1	Free energy and EMF Cell potentials	Electrochemical cells / galavanic cells, cell representation, cell potential, relationship between cell potential and free energy (no derivation)
		SLO-2	The Nernst equation and applications	Nernst equation – Derivation
	S-8	SLO-1	Nernst equation applications- Acid base, oxidation-reduction , Solubility equilibria	acid-base , redox and (Brief account and expression only)- continued below
		SLO-2	Nernst equation applications- Acid base, oxidation-reduction , Solubility equilibria	solubility product (Brief account and expression only)
	S-9	SLO-1	Corrosion	Definition, Types- Dry and Wet [Hydrogen evolution and Oxygen absorption types only],
		SLO-2	Corrosion	Mechanism for Dry and wet - continuation of the above
	S-10	**SLO-1** **SLO-2**	**Tutorial- Electrode potential expression for various electrodes**	
	S-13	SLO-1	Corrosion	Free energy of a corrosion reaction
		SLO-2	Corrosion	Pourbaix diagram for Iron
	S-14	SLO-1	Representations of three dimensional structures	Fischer, Sawhorse and Newmann projections - any one example for each
		SLO-2	Structural isomers and stereoisomers	Structural isomers-Definition, types-chain, position, functional and metamerism with an example for each, Stereoisomers-enantiomers, diastereoisomers – definition with an example for each.
	S-15	SLO-1	Configurations and symmetry and chirality	Configurations-relative and absolute with examples, Symmetry- Elements of symmetry-plane, center of symmetry, alternating axis of symmetry and principal axis or rotational axes of symmetry Chirality- definition with examples
		SLO-2	Enantiomers, diastereomers	Enantiomers- and diastereomers- definition with an example for each.
	S-16	**SLO-1** **SLO-2**	**Tutorial - Discussions on Passivity, corrosion and Immunity taking simple examples.** **Tutorial- Inter conversion of Sawhorse, Newman and Fischer projections with examples**	

5	S-1	SLO-1	Optical activity, absolute configurations	Optical activity-Introduction with types (racemic, mesomers, dl isomers) Absolute configurations: Determination of absolute configuration-Cahn Ingold Prelog rules.
		SLO-2	Conformational analysis	Conformational analysis- conformations of n-butane
	S-2	SLO-1	Isomerism in transition metal compounds-Introduction	1. Stereoisomerism. a) Geometrical isomerism b) Optical isomerism with an example each
		SLO-2	Isomerism in transition metal compounds-Types	2. Structural Isomerism.a) Coordination isomerism, b) Ionization isomerism, c) Hydrate isomerismd) Linkage isomerism with an example each
	S-3	SLO-1	Introduction to reactions involving substitution	Brief account on Nucleophilic and Electrophilic substitution reactions with an example for each, explanation on SN1 mechanism only taking an example.
		SLO-2	Addition reaction	Brief account on Nucleophilic and Electrophilic and Free radical reactions with an example for each, explanation on Free radical mechanism only taking an example.
	S-4	SLO-1	**Tutorial- Differences between electrophile and Nucleophile**	
		SLO-2	**Tutorial- Identifying the type of mechanism taking few reactions(basic) as examples**	
	S-7	SLO-1	Elimination reaction	Brief account on types of elimination reactions- (E1 and E2 only) with an example for each, explanation on E2 mechanism only taking an example.
		SLO-2	Oxidation reaction	Explanation taking $KMnO_4$ and $K_2Cr_2O_7$ as oxidizing agents only.
	S-8	SLO-1	Reduction reaction	Explanation taking $LiAlH_4$ and $NaBH_4$ as reducing agents only.
		SLO-2	Examples	
	S-9	SLO-1	Cyclization	Dieckmann Condensation
		SLO-2	Ring opening reactions	Addition of $Cl_2/Br_2/HI/H_2SO_4/H_2$ to cyclopropane
	S-10	**SLO-1**	**Tutorial- Discussion on other oxidizing and reducing agents taking some reactions as examples**	
		SLO-2	**Tutorial- Discussion on Markovnikov's rule , Anti- Markovnikov's rule, Peroxide effect**	
	S-13	SLO-1	Synthesis of a commonly used drug molecule- Introduction	Drugs-Introduction, examples, Synthesis of Paracetamol and its uses. (No mechanism)
		SLO-2	Synthesis of a commonly used drug molecule- Examples	
	S-14	SLO-1	Synthesis of a commonly used drug molecule- Introduction	Synthesis of Aspirin and its uses. (No mechanism)

		SLO-2	Synthesis of a commonly used drug molecule- Examples	
	S-15	**SLO-1**	**Question Bank Discussion**	
		SLO-2		
	S-16	**SLO-1**	**Tutorial-Other medicinal drugs and its uses**	
		SLO-2		