

Curriculum Plan (Odd Semester 2022-2023) Semester-V

Teacher Name: Dr. Shiv Kumar

Name of Paper & Code: 42177925, B.Sc. LIFE SCIENCE –DSE, Chemistry of d-Block Elements, Quantum Chemistry, Photochemistry, & Spectroscopy (4 Periods Per Week)

Contents	Allocations of Lectures	Month wise Schedule to be followed	Tutorials/ Assignment/ Presentation
<p>Transition Elements (3d series): General properties of elements of 3d series with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties and ability to form complexes. A brief introduction to Latimer diagrams (Mn, Fe and Cu) and their use to identify oxidizing, reducing species and species which disproportionate. Calculation of skip step potentials. Lanthanoids and actinoids: Electronic configurations, oxidation states displayed. A very brief discussion of colour and magnetic properties. Lanthanoid contraction (causes and consequences), separation of lanthanoids by ion exchange method.</p>	10	July – 23rd week of August – 13th	Related Problems, Class Test, Home - Register Overview, -Related Problems, -Previous Year Qsn Papers discussion, - Assignment
<p>Coordination Chemistry: Brief discussion with examples of types of ligands, denticity and concept of chelate. IUPAC system of nomenclature of coordination compounds (mononuclear and binuclear) involving simple monodentate and bidentate ligands. Structural and stereoisomerism in complexes with coordination numbers 4 and 6.</p>	6	August – 16 th week of August – 27 th	
<p>Bonding in coordination compounds: Valence Bond Theory (VBT): Salient features of theory, concept of inner and outer orbital complexes of Cr, Fe, Co and Ni. Drawbacks of VBT.</p>	14	August – 29 th week of September – 24 th	- Syllabus Overview - Reference Books - Problem Solving
<p>Crystal Field Theory: Splitting of d orbitals in octahedral symmetry. Crystal field effects for weak and strong fields. Crystal field stabilization energy (CFSE), concept of pairing energy. Factors affecting the magnitude of Δ. Spectrochemical series. Splitting of d orbitals in tetrahedral symmetry. Comparison of CFSE for octahedral and tetrahedral fields, tetragonal distortion of octahedral geometry. Jahn-Teller distortion, square planar coordination.</p>			

<p>Quantum Chemistry: Postulates of quantum mechanics, quantum mechanical operators. Free particle. Particle in a 1-D box (complete solution), quantization, normalization of wave functions, concept of zero-point energy. Rotational Motion: Schrödinger equation of a rigid rotator and brief discussion of its results (solution not required). Quantization of rotational energy levels. Vibrational Motion: Schrödinger equation of a linear harmonic oscillator and brief discussion of its results (solution not required). Quantization of vibrational energy levels.</p>	12	September –26 th week of October – 18 th	- Related Problems, Class Test, Home - Register Overview, -Related Problems, -Previous Year Qsn Papers discussion, - Assignment
<p>Spectroscopy: Spectroscopy and its importance in chemistry. Wave-particle duality. Link between spectroscopy and quantum chemistry. Electromagnetic radiation and its interaction with matter. Types of spectroscopy. Difference between atomic and molecular spectra. Born-Oppenheimer approximation: Separation of molecular energies into translational, rotational, vibrational and electronic components. Microwave (pure rotational) spectra of diatomic molecules. Selection rules. Structural information derived from rotational spectroscopy. IR Spectroscopy: Selection rules, IR spectra of diatomic molecules. Structural information derived from vibrational spectra. Vibrations of polyatomic molecules. Group frequencies. Effect of hydrogen bonding (inter-</p>	12	October– 22nd week of November – 5 th	

<p>and intramolecular) and substitution on vibrational frequencies. Electronic Spectroscopy: Electronic excited states. Free electron model and its application to electronic spectra of polyenes. Colour and constitution, chromophores, auxochromes, bathochromic and hypsochromic shifts.</p> <p>Photochemistry: Laws of photochemistry. Lambert-Beer's law. Fluorescence and phosphorescence. Quantum efficiency and reasons for high and low quantum yields. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions. Photoelectric cells.</p>	6	November – 7 th week of November – 15 th	<p>- Syllabus Overview - Reference Books</p> <p>- Problem Solving</p>
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