**Lesson Plan [Academic Session 2020-2021]**

**Class: B. Sc First Year [I semester]**

**Subject: (CH-101) Inorganic Chemistry**

**Dr. Amit Kumar, Assistant Professor of Chemistry**

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| **Month** | **Topic** | **Academic Activities** |
| **November, 2020** | **Atomic Structure:** Idea of de Broglie matter waves, Heinsenberg’s uncertainty principle, Atomic orbitals, Quantum numbers, Radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ2, probability distribution curves, shapes of s, p, d, f orbitals, Aufbau and Pauli exclusion principles, Hund’s multiplicity rules, Electronic configuration of elements, effective nuclear charge, Slater’s rules. | Introduction of Syllabus and Course outcomes  Doubt solving sessions |
| **December, 2020** | **Periodic table and Atomic properties:** Classification of periodic table into s, p, d, f blocks, atomic and ionic radii, ionisation energy, electron affinity and electronegativity definition, methods of determination or evaluation, trend in periodic table (in s and p-block elements), Pauling , Mulliken, Allred Rachow and Mulliken Jaffe’s electronegativity scale, Sanderson’s electron density ratio. | Assignment on various topics of Atomic Structure  Discussion on Assignment  Doubt solving sessions |
| **January, 2021** | **Covalent Bond:** Valence bond theory (Heitler-London and Pauling approach) and its limitation, directional characteristics of covalent bond, various type of hybridisation and shapes of simple inorganic molecules and ions (BeF2, BF3, CH4, PF5, SF6, IF7, SO4-2, ClO4-1, NO3-1) valence shell electron pair repulsion (VSEPR) theory to NH3, H3O+, SF4, ClF3, H2O, SnCl2, ClO3-1 and ICl2-1. Molecular orbital theory of homonuclear (N2, O2) heteronuclear (CO and NO) diatomic molecules and ions, bond energy, bond angle, bond length and dipole moments, percentage ionic character from dipole moment and electronegativity difference. | Test of Periodic Table and Atomic properties  Discussion on Test  Doubt solving sessions |
| **February, 2021** | **Ionic Solids:** Ionic structures (NaCl, CsCl, ZnS (Zinc blende), CaF2) size effects, radius ratio rule and its limitations, Madelung constant, Stoichiometric and Non stoichiometric defects in crystals, Lattice energy (mathematical derivation excluded) and Born Haber cycle, Solvation energy and its relation with solubility of Ionic solids, Polarizing power and Polarisability of ions, Fajan’s rule. **Revision of syllabus** | Test of Covalent Bond  Discussion on Test  Doubt solving sessions  Discussion of Previous Years Questions |

**Lesson Plan [Academic Session 2020-2021]**

**Class: B. Sc Second Year [III semester]**

**Subject: (CH-201) Inorganic Chemistry**

**Dr. Amit Kumar, Assistant Professor of Chemistry**

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| **Month** | **Topic** | **Academic Activities** |
| **November, 2020** | **Chemistry of d-Block elements**  Definition of transition elements, position in the periodic table, General characteristic properties of d-Block elements, Comparison of properties of 3d elements with 4d and 5d elements with reference only to ionic radii, oxidation state, magnetic and spectral properties and stereo chemistry. | Introduction of Syllabus and Course outcomes  Doubt solving sessions |
| **December, 2020** | **Chemistry of d-Block elements**  Stability of various oxidation states and e.m.f (Latimer and Frost diagrams), Structure and properties of some compounds of transition elements- TiO2, VOCl2, FeCl3, CuCl2 and Ni(CO)4. | Test of Chemistry of d-block elements  Discussion on Test  Doubt solving sessions |
| **January, 2021** | **Coordination Compounds:** Werner’s theory of coordination compounds, effective atomic number, chelates, nomenclature of coordination compounds, Isomerism in coordination compounds, valence bond theory of transition metal complexes. | Test of Coordination Compounds  Discussion on Test  Doubt solving sessions |
| **February, 2021** | **Non-aqueous solvents:** Physical properties of solvents, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2.    **Revision of syllabus** | Test/Quiz of Non-aqueous solvents  Doubt solving sessions  Discussion of Previous Years Questions |

**Lesson Plan [Academic Session 2020-2021]**

**Class: B. Sc Second Year [III semester]**

**Subject: (CH-202) Physical Chemistry**

**Dr. Amit Kumar, Assistant Professor of Chemistry**

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| **Month** | **Topic** | **Academic Activities** |
| **November, 2020** | **Thermodynamics:** Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Thermodynamic equilibrium, Concept of heat and work. | Introduction of Syllabus and Course outcomes  Doubt solving sessions |
| **December, 2020** | **Thermodynamics:** First law of thermodynamics: statement, concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule–Thomson coefficient for ideal gas and real gas and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. | Assignment on various topics of Thermodynamics  Discussion on Assignment  Doubt solving sessions |
| **January, 2021** | **Chemical Equilibrium:** Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant. Clausius–Clapeyron equation and its applications. | Test of Chemical Equilibrium  Discussion on Test  Doubt solving sessions |
| **February, 2021** | **Distribution Law:** Nernst distribution law – its thermodynamic derivation, Applications of distribution law: (i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride (ii) Determination of equilibrium constant of potassium tri-iodide complex and (iii) Process of extraction. More stress on numerical problems. **Revision of syllabus** | Test/Quiz of Distribution Law  Doubt solving sessions  Discussion of Previous Years Questions |

**Lesson Plan [Academic session 2020-2021]**

**Class: B. Sc Third Year [V semester]**

**Subject: (CH-301) Inorganic Chemistry**

**Dr. Amit Kumar, Assistant Professor of Chemistry**

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| **Month** | **Topic** | **Academic Activities** |
| **November, 2020** | **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 planer complexes, factors affecting the crystal field parameters. | Introduction of Syllabus and Course outcomes  Doubt solving sessions |
| **December, 2020** | **Thermodynamics and Kinetic Aspects of metal complexes:** A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, Irving William Series, substitution reactions of square planer complexes of Pt [II], Trans effect. | Assignment on Metal-Ligand Bonding in Transition Metal complexes  Discussion on Assignment  Doubt solving sessions |
| **January, 2021** | **Magnetic properties of Transition metal complexes:** Types of magnetic materials, magnetic susceptibility, method of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of µs and µeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes. | Test of Magnetic properties of Transition metal complexes  Discussion on Test  Doubt solving sessions |
| **February, 2021** | **Electronic spectra of Transition metal complexes:** Selection rules for d-d transition, spectroscopic ground states, spectrochemical series, orgel energy level diagram for d1 and d9states, discussion of electronic spectrum of [Ti(H2O)6]+3 complex ion.    **Revision of syllabus** | Test/Quiz of Electronic spectra of Transition metal complexes  Doubt solving sessions  Discussion of Previous Years Questions |

**Lesson Plan [Academic Session 2020-2021]**

**Class: B. Sc Third Year [V semester]**

**Subject: (CH-302) Physical Chemistry**

**Dr. Amit Kumar, Assistant Professor of Chemistry**

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| **Month** | **Topic** | **Academic Activities** |
| **November, 2020** | **Quantum Mechanics-I:** Black-body radiation, Plank’s radiation law, photoelectric effect, postulates of quantum mechanics, quantum mechanical operators, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box. | Introduction of Syllabus and Course outcomes  Doubt solving sessions |
| **December, 2020** | **Physical Properties and Molecular Structure:** Optical activity, polarization-(Clausius-Mossotti equation derivation excluded). Orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetism. | Test on various topics of Physical Properties and Molecular Structure  Discussion on Test  Doubt solving sessions |
| **January, 2021** | **Spectroscopy:** Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born-oppenheimer approximation, Degrees of freedom.  **Rotational Spectrum:** Selection rules, Energy levels of rigid rotator (semi-classical principles), rotational spectra of diatomic molecules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length and isotopic effect. | Test of spectroscopy  Discussion on Test  Doubt solving sessions |
| **February, 2021** | **Vibrational spectrum:** Selection rules, Energy levels of simple harmonic oscillator, pure vibrational spectrum of diatomic molecules, determination of force constant and qualitative relation of force constant and bond energy, idea of vibrational frequencies of different functional groups.  **Raman Spectrum:** Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, Quantum theory of Raman spectra **Revision of syllabus** | Test/Quiz of Vibrational and Raman spectrum  Doubt solving sessions  Discussion of Previous Years Questions |