Even Semester: **Inorganic**

B.Sc 2nd Sem –**Inorganic Chemistry**

APRIL Week-2	**Hydrogen Bonding and Van der Waals forces** Hydrogen Bonding – Definition, types, effects of hydrogen bonding on properties of substances, application Brief discussion of various types of Van der Waals forces.
Week-3	**Metallic Bond and semiconductors** Metallic bond – Qualitative idea of valence bond and Band theories of metallic bond (conductors, semiconductors, insulators). Semiconductors – Introduction, types and applications.
Week-4	**s-Block elements** Comparative study of the elements including diagonal relationship, Anomalous behaviour of Lithium and Beryllium compared to other elements in the same group, salient features of hydrides, oxides, halides, hydroxides (methods of preparation excluded), behaviour of solution in liquid NH_3.
MAY Week-1	**Chemistry of Noble Gases** General physical properties, low chemical reactivity, chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon
Week-2	**ASSINGMENT -1** **p-Block elements:** Electronic configuration, atomic and ionic size, metallic character, melting point, ionization energy, electron affinity, electronegativity, inert pair effect and diagonal relationship.
Week-3	**Boron family (13th group):** **Diborane**: Preparation, properties and structure (as an example of electron deficient compound and multicenter bonding), Borazine chemical properties and structure, relative strength of Trihalide of Boron as lewis acids, structure of aluminium(III) chloride.
Week-4	**Carbon family and Nitrogen family (14th and 15th group):** Catenation, Carbides, fluoro carbons, silicates (structural aspects). Oxides: Structure of oxides of nitrogen and phosphorus

JUNE Week-1	**ASSIGNMENT-2** **Oxyacids :** Structure and relative acid strength of oxy acids of nitrogen and phosphorus, structure of white and Red phosphorus
Week-2	**Oxygen family (16th group):** Oxy acids of sulphur – structure and acidic strength, Hydrogen Peroxide – properties and uses.
Week-3	**SESSIONAL** **Halogen family (17th group):** Interhalogen compounds (their properties and structures)
Week-4	Hydra and oxy acids of chlorine – structure and comparison of acid strength, cationic nature of Iodine.
July Week-1	**(THEORY+PRACTICAL)EXAMINATION**

B.SC – 4rd Sem. **INORGANIC CHEMISTRY**

APRIL Week-2	**Basic Introduction OF F-BLOCK ELEMENTS**
Week -3	**Chemistry of f-Block elements** Lanthanides: Electronic structure, oxidation states, magnetic properties, complex formation,
Week -4	colour, ionic radii and lanthanide contraction, occurrence, separation of lanthanides, Lanthanide compounds.

MAY Week -1	Actinides: General characteristics of actinides, chemistry of separation of Np, Pu and Am from uranium .
Week -2	Transuranic elements, comparison of properties of Lanthanides and actinides with transition elements.
Week -3	**Theory of Qualitative and Quantitative Analysis** Chemistry of analysis of various groups of basic and acidic radicals,
Week -4	Chemistry of identification of acid radicals in typical combination, chemistry of interference of acid radicals including their removal in the analysis of basic radicals**.**
JUNE Week-1	**ASSIGNMENT-2** Common Ion effect, solubility product
Week-2	Theory of precipitation, co-precipitation, post-precipitation, purification of precipitates.
Week-3	**SESSIONAL**
Week-4	**REVISION**
JULY Week-1	(**THEORY+PRACTICAL) EXAMINATION**

B.Sc-VI Sem **Inorganic Chemistry**

APRIL Week-2	**Basic-Indroduction OF Acids-Bases**
Week-3	**Acids and Bases** Arrhenius, Bronsted-lowry, Lux-flood, solvent system and Lewis concept of acids and bases, relative strength of acids and bases, levelling solvents, hard and soft acids and bases(HSAB), Applications of HSAB principle.
Week-4	**Organometallic chemistry** Definition, classification and nomenclature of organometallic compounds
MAY Week-1	Preparation, properties and bonding of alkyls of Li, Al, Hg and Sn, concept of hapticity of organic ligand,
Week-2	**ASSIGNMENT-1** Structure and bonding in metal-ethylenic complexes, Structure of Ferrocene, classification in metal carbonyls, preparation, properties and bonding in mononuclear carbonyls.
Week-3	**Bio inorganic chemistry** Metal ions present in biological system, classification on the basis of action (essential, non essential, trace, toxic)
Week-4	Metalloporphyrins with special reference to haemoglobin and myoglobin.
JUNE Week-1	**ASSIGNMENT-2** Biological role of Na^{+}, K^{+}, Ca^{+2}, Mg^{+2}, Fe^{+2} ions, Cooperative effect, Bohr effect.
Week-2	**Silicones and Phosphazenes** Nomenclature, classification, preparation and uses of silicones,
Week-3	**SESSIONAL** Elastomers, polysiloxane copolymers,
Week-4	Poly phosphazenes and bonding in triphosphazene.
JULY	**(THEORY+PRACTICAL)EXAMINATION**

Week-1	

Physical Chemistry:

B.SC –2nd Sem **PHYSICAL CHEMISTRY**

Week-2 April	**CHEMICAL KINETICS:** Rate of reaction, rate equation, factors influencing the rate of a reaction-Concentration, temperature, pressure, solvent, light, catalyst.
Week-3 April	Order of a reaction, integrated rate expression for zero order, first order, second order and third order reactions.
Week -4 April	Half life period of a reaction, Methods of determination of order of reaction. Effect of temperature on the rate of reaction-Arrhenius equation
Week -1 May	Theories of reaction rate- Simple collision theory for unimolecular and bimolecular collision. Transition state theory of bimolecular reactions.
Week -2 May	**Assignment-1** **ELECTROCHEMISTRY:** Electrolytic conduction, Factors affecting electrolytic conduction, molar conductance, equivalent conductance and relation among them, their variation with concentration.
Week -3 May	Arrhenius theory of ionization, Ostwald's Dilution Law, Debey-Huckel-Onsager's equation for strong electrolytes (elementary treatment only).
Week -4 May	Transport number, definition and determination by Hittorfs methods, Kohlrausch's law, Calculation of molar ionic conductance and effect of viscosity, temperature and pressure on it.

Week -1 June	**Assignment-2** Applications of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution + Numericals
Week-2 June	Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of sparingly soluble salts, conductometric titrations.
Week-3 June	**SESSIONAL**
Week-4 June	Definition of pH and pK_a , Buffer action, Henderson-Hazel equation, Buffer mechanism of buffer action
Week-1 July	**(THEORY + PRACTICAL)EXAMINATION**

B.SC –4th Sem **PHYSICAL CHEMISTRY**

Week-2 April	**Thermodynamics** Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency.
Week-3 April	Carnot's theorem, Thermodynamics scale of temperature. Concept of entropy – entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, entropy as a criteria of spontaneity and equilibrium.
Week -4 April	Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data.

Week -1 May	Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, G as criteria for thermodynamic equilibrium and spontaneity, its advantage over entropy change. Variation of G with P, V and T.
Week -2 May	**Assignment-1** **Electrochemistry** Electrolytic and Galvanic cells – reversible & irreversible cells, conventional representation of electrochemical cells.
Week -3 May	Calculation of thermodynamic quantities of cell reaction (▲G, ▲H & K). Types of reversible electrodes – metal- metal ion, gas electrode, metal – insoluble salt- anion and redox electrodes. Electrode reactions.
Week -4 May	Nernst equations, derivation of cell EMF and single electrode potential. Numericals
Week -1 June	**Assignment-2** Standard Hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, Concentration cells with and without transference.
Week-2 June	Liquid junction potential and its measurement.Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode. Numericals
Week-3 June	**SESSIONAL**
Week-4 June	**Revision**
Week-1 July	**(THEORY + PRACTICAL)EXAMINATION**

B.SC –6th Sem **PHYSICAL CHEMISTRY**

Week-2 April	**Introduction to Statistical Mechanics** Need for statistical thermodynamics, thermodynamic probability, Maxwell Boltzmann distribution statistics, Born -Oppenheimer approximation.
Week-3 April	Partition function and its physical significance, Factorization of partition function.
Week -4 April	**Photochemistry** Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthus-Drapper law, StarkEinstein law (law of photochemical equivalence).
Week -1 May	Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).
Week -2 May	**Assignment-1** **Solutions, Dilute Solutions and Colligative Properties:** Ideal and non-ideal solutions, methods of expressing concentrations of solutions, Dilute solutions, Raoult's law.
Week -3 May	Colligative properties: (i) relative lowering of vapour pressure (ii) Elevation in boiling point (iii) depression in freezing point (iv) osmotic pressure.
Week -4 May	Thermodynamic derivation of relation between amount of solute and elevation in boiling point and depression in freezing point. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.
Week -1 June	**Assignment-2** **Phase Equillibrium** Statement and meaning of the terms – phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule,
Week-2 June	Phase equilibria of one component system –Example – water system. Phase equilibria of two component systems solid-liquid equilibria, simple eutectic Example Pb-Ag system, desilverisation of lead.

Week-3 June	**SESSIONAL**
Week-4 June	**Revision**
Week-1 July	**(THEORY + PRACTICAL)EXAMINATION**

Organic Chemistry

B.Sc I Sem-2 Organic Chemistry

Week-2 April	**Alkenes** Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halide. The Saytzeff rule, Hofmann elimination, physical proper ties and relative stabilities of alkenes.
Week-3 April	Chemica l reactions of alkenes· mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration–oxidation, oxymercurationreduction, ozonolysis, hydration, hydroxylation and oxidat ion with $KMnO_4$.
Week-4 April	**Arenes and Aromaticity** Nomenc lature of benzene deriva tives: Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aroma tic ions, annulenes up to 10 carbon atoms, aromatic, anti-aromatic and non-aromatic compounds.
Week-1 May	Aromatic electrophilic substitution· general pattern of the mechanism, mechansim of nitration, halogenation, sulphonation, and Friedel-Crafts reaction.
Week-2 May	**Assignment-1+** Energy profile diagrams. Activating, deactivating substituents and orientation.

Week-3 May	**Dienes and Alkynes** Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of butadiene. Chemical reactions · 1,2 and 1,4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes. Methods of formation.
Week-4 May	Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation of alkynes.
Week-1 June	**Assignment-2+ Alkyl and Aryl Halides** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions.
Week-2 June	Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams.
Week-3 June	**Sessional +** Methods of formation and reactions of aryl halides
Week-4 June	The addition eliminat ion and the elimination-addition mechanisms of nucleophilic aromatic substitution rea ctions. Relative reactivities of alkyl halides *vs* allyl, vinyl and aryl halides.
Week-1 July	**(Theory and Practical) Examinations**

B.Sc II Sem-4 Organic Chemistry

Week-2 April	**Infrared (IR) absorption spect roscopy** Molecular vibrations, Hooke 's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region,
Week-3 April	Characteristic absorptions of various func tional groups andinterpretation of IR spec tra of simple organic compounds. Applicat ions of IR spectroscopy in structure elucidation of simple organic compounds.
Week-4 April	**Amines** Structur e and nomenclature of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines.

	Structur al features affecting basicity of amines.
Week-1 May	Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabriel - phthalimide reaction, Hofmann bromamide reaction.
Week-2 May	**Assignment-1+** Electrophilic aromatic subst itution in aryl amines, reactions of amines with nitrous acid.
Week-3 May	**Diazonium Salts** Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO_2 and CN groups, reduction of diazonium sa lts to hyra zines, coupling reaction and its synthetic application. .
Week-4 May	**Aldehydes and Ketones** Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent), pyridinium chlorochromate (PCC) and pyridinium dichromate
Week-1 June	**Assignment-2 +** Physical properties, Comparison of reactivities of aldehydes and ketones.
Week-2 June	Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives.
Week-3 June	**Sessional +** Wittig reaction. Mannich reaction and Cannizzaro reaction.
Week-4 June	Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions.
Week-1 July	**(Theory and Practical) Examinations**

B.Sc III Sem-6 Organic Chemistry

Week-2 April	**Organic Synthesis *via* Enolates** Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.
Week-3 April	**Heterocyclic Compounds** Introduc tion: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasi s on the mechanism of electrophilic substitution.
Week-4 April	Mechanism of nucleophilic substitution reactions in pyridine derivatives. Compar ison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six- membered heterocycles.
Week-1 May	Prepration and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler Napieralski synthesis.
Week-2 May	**Assignment-1+** Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline.
Week-3 May	**Amino Acids, Peptides& Proteins** Classification, of amino acids. Ac id-base behavior, isoelectric point and electrophoresis. Preparation of α-amino acids. Structure and nomenclature of peptides and proteins.
Week-4 May	Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides.
Week-1 June	**Assignment-2+** Classical peptide synthesis, solid–phase peptide synthesis. Structures of peptides and proteins : Primary & Secondary structure.
Week-2 June	**Synthetic Polymers** Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler –Natta polymerization and vinyl polymers.
Week-3 June	**Sessional**
Week-4 June	Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins. Natural and synthetic rubbers.

Week-1 July	**(Theory and Practical) Examinations**