

**Dr. Suresh Kumar**

**Lesson BSC II 4<sup>th</sup> Sem CHEM MAJOR**

**January 2026**

### **D and F Block Elements**

Chemistry of d-Block elements Definition of transition elements, General characteristic properties of d-Block elements, Comparison of ionic radii 3d, 4d and 5d series elements, magnetic properties, Stability of various oxidation states and Latimer and Frost diagrams, Structure of some compounds of transition elements-  $\text{TiO}_2$ ,  $\text{VOCl}_2$ ,  $\text{FeCl}_3$ ,  $\text{CuCl}_2$  and  $\text{Ni}(\text{CO})_4$ .

Chemistry of f-Block elements Lanthanide contraction, oxidation states, magnetic properties, complex formation, colour and ionic radii. Actinides: General characteristics of actinides, Transuranic elements, comparison of properties of Lanthanides and actinides with transition elements.

**February 2026**

### **Thermodynamics-I**

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.

### **Theory of Qualitative and Quantitative**

Analysis Chemistry of analysis of various groups of basic and acidic radicals, chemistry of identification of acid radicals in typical combination, common ion effect, solubility product, theory of precipitation, co-precipitation, post precipitation, purification of precipitates.

**March 2025**

### **Chemical Equilibrium**

Concept of Equilibrium constant, Temperature dependence of equilibrium constant, Clausius– Clapeyron equation and its applications.

### **Alcohols**

Monohyric alcohols: nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids, and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols.

**April 2025**

Phenols Nomenclature, structure, and bonding. Preparation: Cumene hydroperoxide method, from diazonium salts, physical properties, and acidic character. Chemical Reactions: —electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction. Aldehydes and Ketones Nomenclature and structure of the carbonyl group. Preparation: oxidation of alcohols, from acid chlorides and from nitriles, Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group: benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction, Baeyer–Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen and Wolff-Kishner reductions.

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**Lesson BSC III 6th Sem CHEM MAJOR**

**January 2026**

I Bioinorganic chemistry Metal ions present in biological system, classification based on action (essential, non-essential, trace, toxic), Metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Fe}^{+2}$  ions, Cooperativity effect, Bohr effect.

**February 2026**

Photochemistry Interaction of radiation with matter, difference between thermal and photochemical process, Law of photochemistry: Lambert-Beer Law, Grothaus-Draper Law, Stark Einstein Law (Law of photochemical equivalence), calculation of integrated absorption coefficient from electronic spectra, oscillator strength, concept of singlet and triplet states, Jablonski diagram – depicting various processes occurring in excited states including fluorescence, phosphorescence and non-radiative processes (internal conversion, intersystem crossing). Calculation of lifetime of excited states. Quantum Yield, Photosensitized reaction- energy transfer process (Simple example).

**March 2026**

IR Spectroscopy Infrared (IR) absorption spectroscopy Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. NMR Spectroscopy Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and nonequivalent protons, positions of signals and chemical shift, shielding and deshielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons. Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide and 1,1-dibromoethane.

**April 2026**

Amino Acids, Peptides Amino acids, Peptides, and their classification.  $\alpha$ -Amino Acids-Synthesis, ionic properties, and reactions. Zwitterions, pKa values, isoelectric point, and electrophoresis; Study of peptides: Synthesis of peptides using N-protecting, C-protecting, and C-activating groups. Carbohydrates Occurrence, classification, and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose

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**February 2026**

Interaction of radiation with matter, difference between thermal and photochemical process, Law of photochemistry: Lambert-Beer Law, Grotthus-Draper Law, Stark Einstein Law (Law of photochemical equivalence), concept of singlet and triplet states, Jablonski diagram– depicting various process occurring in excited states including fluorescence , phosphorescence and non-radiative processes (internal conversion, intersystem crossing).

**March 2026**

Localized and delocalized chemical bond, Van der Waals interactions. Concept of resonance and its applications, hyperconjugation, inductive effect, Electromeric effect and their comparison. Benzene and its derivatives: Nomenclature, Aromatic nucleus and side chain, Huckel's rule of aromaticity. Aromatic electrophilic substitution, mechanism of nitration, halogenation and Friedel- Crafts reaction. Energy profile diagrams. Activating and deactivating substituents.

**April 2026**

Definition, classification of biomolecules, importance of biomolecules in living organisms. Carbohydrates: Classification, structure and properties of monosaccharides, disaccharides structure and bonding (lactose and sucrose). Proteins: Amino acids, structure, classification and properties, peptide bond and elementary idea of structure of proteins.