Government College Dujana

Department of Chemistry

Session: 2025-2026

Lesson Plan Semester - V

Name of Faculty : Professor Rajni and Dr Sanjay Kumar

Subject : Inorganic Chemistry

B.Sc. III

July 2025

Fourth week **Unit I- Metal Ligand Bonding in Transition Metal Complexes**

Limitations of valence bond theory

August 2025

Inorganic

First week- An elementary idea of crystal field theory. Crystal field splitting in octahedral complexes.

Second week - Crystal field splitting in tetrahedral and square planar complexes.

Third week – Factors affecting crystal field parameters.

Fourth week – **Unit II - Thermodynamic & Kinetic aspects of Metal Complexes**

A brief outline of thermodynamic stability of metal complexes.

September 2025

Inorganic

First week- Factors affecting the stability of metal complexes.

Second week - Substitution reactions in Square planar complexes of Pt(II)

Third week – Trans effect and Assignment

Fourth week – **Unit – III Magnetic Properties of Transition Metal Complexes**

Types of magnetic behaviour, methods of determining magnetic susceptibility

(Assignment and Test)

October 2025

Inorganic

First week- Spin only formula.

Second week- LS coupling, correlation of μ_s and μ_{eff} values. Orbital contribution to magnetic moments.Application of magnetic moment data for 3d- metal complexes.

Third week – Diwali Break

Unit- IV Electronic Spectra of Transition Metal complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states.

Fourth week – Spectrochemical series.orgel- energy level diagram of d^1-d^9 states.

November 2025

Inorganic

First week- Revision of Unit –III. ((Assignment and Test)

Second week- Discussion of electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Third week – Revision &Problem solving

Government College Dujana

Department of Chemistry

Session: 2025-2026

Lesson Plan Semester - V

Name of Faculty : Dr Sanjay Kumar

B.Sc. III

Subject - **Organic Chemistry**

July 2025

NMR spectroscopy – I

Introduction, Magnetic properties of nuclei, Principle of nuclear magnetic resonance, PMR spectrum

August 2025

First Week- Nuclear spin states.

SECOND Week- NMR spectrometer, position of signals. chemical shift

Third week: number of signals, peak areas, equivalent and nonequivalent protons

Fourth week: shielding and deshielding of protons, proton counting.

September 2025

First Week- splitting of signals, coupling constants. magnetic equivalence of protons.

SECOND Week- Applications of PMR spectroscopy., Limitations of PMR spectroscopy.

Third week: Discussion of PMR spectra of the molecules, ethyl bromide, n-propyl bromide, isopropyl bromide.

Fourth week: 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol.,acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone

OCTOBER 2025

First week - Simple problems on PMR spectroscopy for structure determination of organic compounds. **(Assignment and Test)**

Second week: Organomagnesium compounds- the Grignard Reagents-formation, structure, Chemical reaction, Group revision and Problem solving.

Third week: Diwali Break

Fourth week: organo zinc compounds, formation, - chemical reactions of organozinc compounds organolithium compounds chemical reactions of organolithium compounds

NOVEMBER 2025

First week: - Classification and nomenclature. - Monosaccharides, Mechanism of osazone formation, interconversion of glucose and fructose, Mechanism of mutarotation. Structures of ribose and deoxyribose (Assignment and Test)

Second week. Chain lengthening and shortening of aldoses, Configuration of monosacharides, Introduction to disaccharides and polysaccharides without involving structure determination.

Third week – Erythro and threo diastereomers.,Open chain and cyclic structure of D (+)-glucose Open chain and cyclic structure of D (-) – fructose, Introduction to disaccharides and polysaccharides without involving structure determination.

Government College Dujana

Department of Chemistry

Session: 2025-2026

Lesson Plan Semester - V

Name of Faculty : Professor Rajni

Subject : Physical Chemistry B.Sc. III

JULY 2025

Quantum Mechanics

Week 4: Black body radiation, Planks radiation Law, Photoelecric effect.

SEPTEMBER 2025

Week 1: Heat capacity of solids, Comptons effect. Wave function and its significance postulates of quantum mechanics. Quantum mechanical operator, commutation relations, Hamiltonian operators, Hermitian operators.

Week 2: Average value of square of hermitian as a positive quantity, Role of operator in quantum mechanics to show quantum mechanically that position and momentum cannot be predicted simultaneously, determination of wave function and energy of particle in one dimensional box, pictorial representation and its significance.Numerical problems

Week 3: test and problems discussion of unit 1

Week 4: Optical activity, clausius – Mossotti equation. Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, (Assignment)

OCTOBER 2025

Week 1: Magnetic permeability, magnetic susceptibility and its determination. Applica tion of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetics.

Week 2: Spectroscopy-introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born oppenheimer approximation, Degrees of freedom, Rotational Spectrum Diatomic molecules. Energy levels of rigid rotator (semi-classical principles), selection rules

Week 3: test & Diwali vacations

Week 4: (Assignment and Test) spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect, Vibrational spectrum Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity

November 2025

Week 1: determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra. idea of vibrational frequencies of different functional groups. Raman Spectrum: Concept of polarizibility,

Week 2: pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra

Government College Dujana,

Department Lesson Plan BSc -II Sem - 3rd

2025-26

Name of Faculty – Prof Rajni and Dr Sanjay Kumar

Class – BSc II Fundamental Chemistry -III

July 2025

Third Week Unit 1 Chemistry of Transition series elements

General characteristics of transition metals, Brief discussion of differences between the first, second and third transition series, stability of various oxidation states, magnetic and spectral properties.

Fourth Week Binary compounds and complexes, illustrating relative stability of their oxidation states, chemistry of Ti, V, Cr, Mn, Fe, Co, Mo and W in various oxidation states, some important compounds as laboratory reagents, potassium dichromate, potassium permanganate.

August 2025

First Week Some important compounds as laboratory reagents potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitride.

Unit–II Thermodynamics-II

Third law of thermodynamics: Nernst heat theorem, concept of residual entropy.

Second Week Evaluation of absolute entropy from heat capacity data.

Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function

(A) as thermodynamic quantities.

Third Week A & G as criteria for spontaneity, thermodynamic

equilibrium and their advantage over entropy change. Variation of G

and A with P, V and T. Partial molar quantities. **(ASSIGNMENT)**

Fourth Week Revision, Problem solving &Test

Fourth Week Revision, Problem solving &Test

September 2025

First Week Unit–III Electrochemistry

Arrhenius theory of ionization, Ostwald's Dilution Law. Debye-Huckel–Onsager's equation for strong electrolytes (elementary treatment only).

Second Week Transport number, definition and determination by Hittorf's methods. Electrolytic conduction, factors affecting electrolytic conduction. Applications of conductivity measurements: determination of dissociation constant (Ka) and degree of dissociation.

Third Week Determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pKa, buffer solution, buffer action.

.Fourth Week Henderson – Hasselbalch equation, buffer mechanism of buffer action. Reversible electrodes – Metal- metal ion gas electrode, metal – metal insoluble salt- anion electrode and redox electrode. **Revision**

October 2025

First Week Unit–IV Alkyl and aryl halides

Alkyl halide: Nomenclature and classes of alkyl halides, general methods of preparation, physical properties and chemical reactions.

Second Week Mechanisms (SN1, SN2, E1, E2 and E1cb), stereochemistry of nucleophilic substitution reactions of alkyl halides with energy profile diagrams.

Third Week Diwali Holidays

Fourth Week

Elimination vs substitution reactions. Aryl halides: Methods of preparation, Reactions: Aromatic nucleophilic substitution and effect of substituents on reactivity.

November 2025

First Week Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3), reactivity and relative strength of C-halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Second Week Revision and Group Discussion.

Third Week Problem solving

Government College Dujana,

Department Lesson Plan BSc -II Sem - 3rd

2025-26

Name of Faculty – Dr Sanjay Kumar

Class – BSc II S E C - -III

July 2025

Third Week Unit–I Basic Concepts

Components of cells and batteries & Classification of cells and batteries, About operation of a cell & theoretical cell voltage.

Fourth Week Capacity, energy, specific energy of practical batteries, About energy density of practical batteries.

August 2025

First Week **Unit–II Battery Design and Factors Affecting Battery**

Performance General introduction, designing to eliminate potential safety

problems.

Second Week Battery safeguards when using discrete batteries, battery construction.

Third Week Design of rechargeable batteries, factors affecting battery performance.

(ASSIGNMENT)

Fourth Week Revision, Problem solving &Test of Unit 1

September 2025

First Week Unit–III Primary Batteries
General characteristics and applications of primary batteries, types and characteristics of primary batteries, comparison of the performance characteristics of primary battery systems.

Second Week Recharging primary batteries. A) Zinc-Carbon Batteries (Leclanche´ and Zinc Chloride Cell Systems): General characteristics, cell chemistry, types of cells and batteries, construction, cell components.

Third Week Magnesium and Aluminum Batteries: General characteristics, cell chemistry, construction of Mg/MnO2 batteries, performance characteristics of Mg/MnO2 batteries

Fourth Week Sizes and types of Mg/MnO2 batteries, other types of magnesium primary batteries. Revision

October 2025

First Week Unit–IV Secondary Batteries

General characteristics and applications of secondary batteries, types and characteristics of secondary batteries.

Second Week Comparison of performance characteristics for secondary battery systems and introduction, chemistry, construction, performance characteristics.

Third Week Diwali Holidays

Fourth Week Charging characteristics of following batteries: Lead batteries,

Lithium ion batteries, Iron electrode batteries, Nickel-Cadmium.

November 2025

First Week Nickel-Metal hydride,

NickelZinc batteries.

Second Week Revision and Group Discussion.

Third Week Problem solving

Government College Dujana,

Department Lesson Plan BSc -I Sem - I

2025-26

Name of Faculty – Prof Rajni and Dr Sanjay Kumar

Class – BSc I Fundamental Chemistry -I

July 2025

Unit 1 Chemistry of Transition series elements

General characteristics of transition metals,briefs discussion of difference between the first second and third transition series,stability of various states,magnetic and spectral properties

AUGUST 1ST WEEK

Binary compounds and complexes illustrating relative stability of their oxidation states.chemistry of Ti,V,Cr,Mn,Mo,and W in various oxidation states,some important compounds as laboratory reagents potassium dichromate,potassium permanganate sodium cobaltnitrite

Second Week

Unit2: THEERMODYNAMICS-||

Third law of dynamics :Nernst heat theorem,concept of residual entropy,evaluation of absolute entropy from heat capacity data.Gibbs and Helmholtz functions,Gibbs function(G) and Helmholtz functions(A) as thermodynamic quantities,A&G as criteria of spontaniety

Third Week

Thermodynamic equilibrium and their advantage over entropy change. Variation of G and A with P,V,and T . Partial molar quantities

Fourth Week

Arehenius theory of ionization,ostwald`s dilution law,Debye - Huckel-onsager`s equation for strong electrolyte(elementary treatment only).

SEPTEMBER 1ST WEEK

Unit3:Electrochemistry

Transport number ,defination and determination by Hittorf`s methods.Electrolyte conduction,factor affecting electrolytic conduction.

Second Week

Applications of conductivity measurements:determination of dissociation constant(Ka) and degree of dissociation,determination of solubility product of sparingly soluble salts

Third Week

conductometric titrations. Definition of pH and pKa

Fourth Week

Buffer solution ,buffer action ,Henderson -Hasselbatch equation ,buffer mechanism of buffer action,

October I Week

Revesible electrodes- Metal-metal ion gas electrode,metal-metal insoluble salt-anion electrode and redox electrode.

October 2nd WEEK

Alkyl and aryl halides

Alkyl halide:Nomenclature and classes of alkyl halides,general methods of preparation,physical properties and chemical reactions

Third Week ---------- Diwali holidays

October 4th WEEK

Mechanisms(SN1,SN2,E1,E2,and E1 cb) and stereochemistry of nucleophilic substitution reactions of alkyl halides with energy profile diagrams,

November I Week

Elimination vs substitution reactions

Second Week

Aryl halides Method of preparation,reactions: Aromatic nucleophilic substitution and effect of substituents on reactivity.Benzyme Mechanism:KN2/NH3(or NaNH2/NH3),reactivity and relative strength of C-halogen bond in alkyl,alkyl,benzyl,vinyl and aryl halides

NOVEMBER 3rd WEEK

test and assignments

Government College Dujana,

Department Lesson Plan BSc -I Sem--I

2025-26

Name of Faculty – Prof Rajni
Class – BSc I

SUBJECT- .SEC CHEMISTRY --I,

JULY3rd WEEK

unit 1 Analysis of Soil and Water

Composition of soil, concept of pH and pH measurement of soil, complexometric titrations, chelation,

JULY 4TH WEEK

chelating agents, use of indicators, estimation of calcium and magnesium ions in soil. Definition of pure water,

AUGUST 1S T WEEK

sources responsible for contaminating water, water sampling methods, water purification methods,

AUGUST 2ND WEEK

:determination of dissolved oxygen of a water sample. Major Chemistry-

AUGUSTa 3RD WEEK

:A general study including preparation and uses of the following: Hair dye, soap, shampoo,

AUGUST 4TH WEEK

Suntan lotions, face powder, lipsticks, talcum powder, nail enamel.

SEPTEMBER 1ST WEEK

Pesticides

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides,

.

SEPTEMBER 2nd Week

Brief introduction of structure activity relationship, synthesis and technical manufacture and uses of representative pesticides

SEPTEMBER 3rd WEEK

organochlorines (gammexene), organophosphates (malathion).

SEPTEMBER 4th WEEK

Experimental Techniques

Basic principle of pH metric, potentiometric and conductometric titrations,

October 1st WEEK

Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids and base,

October 2nd WEEK

buffer solution, buffer action, Henderson–Hazel equation

October 4th WEEK

buffer mechanism of buffer action.

NOVEMBER 1st WEEK

group discussion and revision of syllabus.

NOVEMBER 2nd WEEK

test and assignment