



DEPARTMENT OF CHEMISTRY
UNIVERSITY OF LUCKNOW

Ph.D. Chemistry Coursework Syllabus w.e.f. (2024–25)

Paper- 3: Code CCWP: Advance Chemistry

Maximum Marks: 100

Univ Examination: 70

Internal Assessment: 30 (15+10+5)

M.M. 100 (70+30)

Unit-I
Organometallics <ul style="list-style-type: none">• Definition and classification of organometallic compounds and their stability. General synthetic routes to the formation of M-C linkages.• Synthetic and structural aspects of main group elements.• Organotransition Compounds: 18- and 16- electron rules, Transition Metal-Carbon multiple bond compounds, Transition Metal-Carbon π-bonded compounds. A brief introduction of organometallic compound of Lanthanide & Actinides.
Coordination Chemistry: <ul style="list-style-type: none">• Macrocyclic Complexes: Types of macrocyclic ligands- design and synthesis by coordination template effect, di- and poly- nuclear macrocyclic complexes: macrocyclic polyamines and polyethers; applications of macrocyclic complexes.
Unit-II
Supramolecular Chemistry: <ul style="list-style-type: none">• Secondary bonds M---X (M = S, Se, Te; X= N, O, P, S) and weak noncovalent interactions C-H---X (X= O, Cl, Br, I, S).• Self-Process- Programmed Supramolecular Systems: self-assembly of Double-Helical and Triple-Helical metal complexes; the Helicates, Physico-chemical methods of Investigation of supramolecular associations.
Bioinorganic Chemistry: <ul style="list-style-type: none">• Transition metal storage, Transport and Bio mineralization Ferritin, Transferrin and Siderophores.• Biological significance of metal ions Fe, Zn, Cu, Mo, Co, Cr, V & Ni, Metals in medicine, Metal imbalances, diseases and toxicity, organometallics in living organism, Bio methylation.
Unit-III
Applications of Spectroscopy in Structural Identification (Only interpretation)
<ul style="list-style-type: none">• IR Spectroscopy, X-Ray Diffraction Studies• ^1H, ^{13}C, 2D, NMR Spectroscopy• Mass Spectrometry



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Unit-III

Convenient method of isolation, structural & stereochemical studies, identifications of following

- Steroid
- Carbohydrate
- Alkaloids
- Terpenoids.

Use of the following reagents in Organic Synthesis

- Cyanuric Chloride
- TAPC

Unit-IV

Coupling reaction involving Organometallic/Metallic Reagents

- Suzuki Reaction
- Heck reaction
- Kumada Coupling Reaction
- Sonogashira reaction
- Newer Oxidative & Reductive reagent in Chemical research

Electrochemistry

- Electro catalysis, electro catalytic scales, apparent and true current densities, electrochemical active surface area and its determination.
- Electrochemical reaction order, oxidation-reduction. Tafel plots and its applications, exchange current density, cyclic voltammetry, structure of the electrified interface.

Thermodynamics and Solution Chemistry

- Volume changes in solutions, excess thermodynamic function
- Different Approaches of Measurement of Densities of Solvents and Solutions. Measurement of Ultrasonic Velocity in Different Solutions, Acoustic Parameters, Ion-Ion and Ion Solvent, Interactions in Solutions



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Unit-V

Chemical Kinetics

- Kinetics of ligand substitution reaction and its classification.
- Entropy and Volume of activation and its determination.
- Kinetic isotope effect, solvent isotope effect and Linear free energy relationship.

Enzyme Catalysis 1

- Kinetics of enzymes catalyzed reactions, determine the value of Michaelis-Menton constant (KM) using Line Weaver Burk Plot, Physical significance of KM in Enzyme kinetics

Enzyme Catalysis 2

- Effect of temperature and pH on enzyme catalyzed reaction., Ping– Pong mechanism.

Introduction to Nanomaterials

- Classification of Nanomaterial, Synthesis and processing: Mechanical grinding, Wet chemical synthesis, Sol-gel process, Gas phase synthesis, Sputted plasma processing, Microwave plasma processing, Optical, Electrical, Magnetic, Mechanical properties of nanomaterials and its applications