



**Department of Chemistry
University of Lucknow
Lucknow
B.Sc. Syllabus**

Organic Chemistry

Semester V

Paper 7

Max Marks: 100 (80 + 20)

UNIT I

I. Organometallic Compounds: Organomagnesium compounds: the Grignard reagents, formation, structure and chemical reactions. Organozinc compounds; formation and chemical reactions. Organolithium compound formation and chemical reactions.

II. Organosulphur compounds: Nomenclature, structural, features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidene.

III. Heterocyclic compounds

Introduction: Molecular orbital picture and aromatic characteristic of pyrrole, furan, thiophene and pyridine, methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution, mechanism of nucleophilic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six membered heterocycles. Preparation and reactions of indols, quinoline and isoquinoline with special reference to Fisher Indols synthesis, Skraup synthesis and Bischler . Nepieralski synthesis. Mechanism of electrophilic substitution reaction of indole, quinoline and isoquinoline.

UNIT II

IV. Carbohydrates: Classification and nomenclature, configuration and conformation of monosaccharides, Erythro and threo diastereomers, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Formation of glycoside, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+) glucose. Mechanism of mutarotation, structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose, lactose) and polysaccharide/starch and cellulose) without involving structure determination.

UNIT III

V. Amino Acids, peptides, proteins and Nucleic Acids: Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis, Preparation and reaction of a amino acids, structure and nomenclature of peptides and proteins. Classification of proteins, peptides structure determination, and group analysis. Selective hydrolysis of peptides. Classical peptide synthesis, solid phase peptide synthesis. Structure of peptides and proteins level of protein structures. Protein denaturation/renaturation.

Nucleic Acids: Introduction - Classification of nucleic acids Ribonucleosides and Ribonucleotides. The double helical structure of DNA.

VI. Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of



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unsaturated oils, saponification value, iodine value, acid value, soaps, synthetic detergents alkyl and aryl sulphonates.

UNIT IV

VII. Synthetic Polymers: Addition or chain-growth polymerization, Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resin, epoxy resins and poly urithanes. Natural and synthetic rubbers.

VIII. Synthetic Dyes: Colour and constitution / electronic concept classification of dyes. Chemistry and synthesis of Methyl orange, conge red, Malachite green, crystal violet, phenophthalein, Fluorescin, Alizarin and Indigo.



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Physical Chemistry

Semester V

Paper 8

Max Marks: 100 (80 + 20)

UNIT I

- I. Introductory Quantum Mechanics, Physical properties and Molecular Structure: Introductory Quantum Mechanics: Black-body radiation, Plank's radiation law, photoelectric effect, Compton effect.
- II. Physical Properties and Molecular Structure: Optical activity, polarization (Clausius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment, temperature method and refractivity method, dipole moment and structures of molecules, magnetic properties . paramagnetism, diamagnetism and ferromagnetism.

UNIT II

III. Photochemistry

- a. Interaction of radiation with matter, difference between thermal and photochemical processes.
- b. Laws of photochemistry: Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting 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).

UNIT III

- IV. Solutions, Dilute Solutions and Colligative Properties : Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient, Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination, Osmosis, theory of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

UNIT IV

- V. Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy. Thermodynamic derivation of Nernst distribution law and its application. Phase rule and its derivation. Application of Gibbs phase rule for one component system- water and sulphur system, two component system- Bi-Cd, Pb-Ag, desilverization of lead.



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Books suggested (Theory Courses)

- a. Physical Chemistry, G.M. Barrow, International Student Edition, McGraw Hill.
- b. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
- c. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
- d. Physical Chemistry through Problems, S.K. Dogra and S. Dogra Wiley Eastern Ltd.



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Chemistry

Semester V

Practical

Max Marks: 100

A: Inorganic Chemistry

I. Synthesis and Analysis

- a. Preparation of potassium trioxalatoferrate (III), $K_3[Fe(C_2O_4)_3]$ and determination of its composition by permagnometry.
- b. Preparation of Ni-DMG complex, $[Ni(DMG)_2]$
- c. Preparation of copper tetraammine complex, $[Cu(NH_3)_4]SO_4$
- d. Preparation of cis-and trans-bisoxalatodiaqua chromate (III) ion.

II. Colorimetry

- a. To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution.
- b. Determination of Fe^{3+} content by thiocyanate method.

III. Solvent Extraction

- a. Separation and estimation of Mg(II) and Fe(II) Ion Exchange Method
- b. Separation and estimation of Mg(II) and Zn(II).

IV. Chromatography

- a. Chromatographic separation of metal ions.

B: Organic Chemistry

I. Mixture Analysis

- a. Organic mixture separation and identification (two components)

II. Preparation

- b. One step preparation.

C: Physical Chemistry

I. Electrochemistry

- a. To determine the strength of the given acid conductometrically using standard alkali solution.
- b. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
- c. To determine the ionisation constant of a weak acid conductometrically.

II. Refractometry and Polarimetry

- a. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
- b. To determine the specific rotation of cane sugar solution by polarimeter.

III. Molecular Weight Determination

- a. Determination of molecular weight of a non-volatile solute by Rast method/Beckmann freezing point method.
- b. Determination of the apparent molecular weight of non volatile solute at different concentration and determine Van't Hoff factor by ebullioscopy.



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**Chemistry
Practical**

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IV. Colorimetry

- a. To verify Beer-Lambert law for $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given solution of the substance.