

ORGANIC: CARBOHYDRATES, SPECTROSCOPY AND DYES**THEORY****Unit I: Carbohydrates**

Occurrence, classification, reducing and non reducing sugars, reactions and their biological importance.

Monosaccharides: Structure elucidation, relative and absolute configuration of glucose and fructose, co-relation of configuration, characteristic reactions of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures and conformational analysis (elementary idea, anomeric effect), configuration on C-1 in glucose, interconversions of aldoses and ketoses, Kiliani-Fischer synthesis, Ruff's degradation and Wohl's method.

Disaccharides: Nomenclature, applications and structural distinction of maltose, lactose and sucrose; Invert sugar.

Polysaccharides: Elementary treatment of starch, cellulose and glycogen (comparative study of their structures) and their application.

Unit II: Spectroscopy

Introduction to spectroscopy: Electromagnetic radiation, fundamental definitions, electromagnetic spectrum, introduction to concepts of absorption and emission spectroscopy, Beer-Lambert law.

UV spectroscopy: Types of electronic transitions, UV spectrum, λ_{\max} , ϵ_{\max} , chromophores, auxochromes, bathochromic shift, hypsochromic shift (definitions and elementary examples) and solvent effect. Characteristic UV transitions in common functional groups.

General applications of UV spectroscopy including distinction between cis-trans isomers.

Woodward rules for calculating λ_{\max} in following systems:

- Conjugated dienes: alicyclic, homoannular, heteroannular.
- α,β -Unsaturated aldehydes and ketones.
- Extended conjugated systems: dienes, aldehydes and ketones.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations, IR spectrum, fingerprint and group frequency regions and their significance, Hooke's law and vibrational frequency. Factors affecting vibrational frequency in organic compounds.

Characterization of functional groups: alkanes, alkenes, alkynes (only alicyclic systems), aldehydes, ketones, carboxylic acids and their derivatives, hydroxy compounds and amines. Study of hydrogen bonding.

PMR spectroscopy: Basic principles of NMR spectroscopy, PMR scale, chemical shifts (concept of shielding and deshielding), factors influencing chemical shifts, simple spin-spin

couplings, coupling constant, chemical shift equivalence, anisotropic effects in alkenes, alkynes, aldehydes and aromatics. Interpretation of PMR spectra of simple compounds.

Application of UV, IR and PMR in solving structures of simple organic molecules.

Unit III: Dyes

Colour and constitution of dyes: Witt's theory, quinonoid theory, valence bond theory (VBT) and molecular orbital theory (MOT).

Classification of dyes with examples on the basis of mode of application: Acidic, basic, direct, mordant, vat developed and dispersed dyes.

Classification of dyes with examples on the basis of structure: Azo dyes, triphenyl methane dyes, phthalein dyes, xanthene dyes and natural dyes.

Synthesis and uses of following dyes:

Methyl orange, malachite green, phenolphthalein.

Structure elucidation and synthesis of alizarin and indigo.

Recommended Texts:

1. Morrison, Robert Thornton & Boyd, Robert Neilson *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Sixth Edition, 2003.
2. Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Sixth Edition, 2003.
3. Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Fifth Edition, 1975.
4. Graham Solomons, T.W., Craig B. Fryhle *Organic Chemistry*, Ninth edition John Wiley & Sons, Inc. 2008.
5. Kemp, W. *Organic Spectroscopy*, Palgrave Macmillan Education Ltd, Second Edition, 1987.

PRACTICAL

ORGANIC: QUALITATIVE ANALYSIS, PREPARATION AND USE OF IR AND NMR

1. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
2. Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, for e.g. salicylic acid, cinnamic acid, nitrophenols etc.
3. Identification of simple organic compounds by IR spectroscopy and PMR spectroscopy (Spectra to be provided).
4. Preparation of methyl orange.

Recommended Texts:

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education 2009.
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson 2012.

3. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press 2000.
4. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis*, University Press 2000.