

M.Sc. ORGANIC CHEMISTRY
III SEMESTER

CHORT-3.1 : ORGANIC CHEMISTRY-III A

Teaching hours per week : 04 Credits : 04

Total hours : 64

UNIT-I

16 hours

NATURE AND BONDING IN ORGANIC MOLECULE

Delocalized chemical bonding, conjugation, cross conjugation, resonance, hyper-conjugation, bonding in fullerenes.

Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of π -molecules orbitals, annulenes, antiaromaticity, homoaromaticity.

Aromatic character and chemistry of cyclopentadienyl anion, tropylium cation, tropone and tropolone, bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes, synthetic applications of enamines and imines anions in organic synthesis, phase transfer catalysis, crown ethers and graphene.

UNIT-II

16 hours

PHOTOCHEMISTRY

Interaction of radiation with matter, types of excitation, rate of excited molecules, quenching, quantum efficiency, quantum yield, transfer of excitation energy, actinometry, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions, Paterno-Buchi reaction, photoreduction, photochemistry of enones, hydrogen abstraction rearrangement of unsaturated ketones and cyclohexadienones, photochemistry of p-benzoquinones, photochemistry of aromatic compounds with reference to isomerization, addition and substitution, photochemical isomerization of cis and trans alkenes, photo-Fries rearrangement, Barton reaction, Hoffmann-Loefer-Freytag reaction, photochemistry of vision.

UNIT-III

16 hours

PERICYCLIC REACTIONS

Pericyclic Reactions: Classification of pericyclic reactions, molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene, allyl system, Woodward-Hoffman correlation diagram method and Perturbation of molecular orbital (PMO) approach of pericyclic reaction under thermal and photochemical conditions, FMO and PMO approach to the following reactions.

Electrocyclic reactions- Con rotatory and dis rotatory ring closure $4n$ and $4n+2$ and allylic systems, Woodward and Hoffmann selection rules for pericyclic reactions.

Cycloadditions reactions - Antrafacial and suprafacial additions, more emphasis on $[2+2]$ and $[4+2]$ Cycloadditions, Diels-Alder reaction, 1,3-dipolar cycloaddition reactions.

Sigmatropic rearrangements: Antrafacial and suprafacial shift involving carbon moieties, retention and inversion of configuration, Ene, Claisen and Cope reaction.

DYNAMIC STEREOCHEMISTRY

Prochirality: Homotopic, heterotopic, enantiotopic and diastereotopic ligands and faces, identification using addition, substitution and symmetry criteria, nomenclature of stereoheterotopic ligands and faces, symbols for stereoheterotopic ligands in molecules with one or more prochiral centres, chiral and prochiral centre; prochiral plane, symbols for enantiotopic and diastereotopic faces.

Dynamic Stereochemistry: Stereoselectivity in organic synthesis: stereospecific and stereoselective reactions, principle of stereoselectivity-enantioselectivity and diastereoselectivity, use of chiral reagents, Cram's and Prelog's rules, stereoselectivity in addition, elimination, substitution reactions.

REFERENCE BOOKS:

01. Fundamentals of photochemistry, K.K. Rohatgi Mukherjee, Wiley Eastern Limited, (1986)
02. Photochemistry, Carol E Wayne and Richard P Wayne, Oxford University Press, (1996)
03. Organic Photochemistry, J. M. Cozen and B. Halton, Cambridge University Press (I Edition) 1974
04. Molecular Reactions and Photochemistry, C H Deputy and D S Chapman, Prentice Hall India, New Delhi (1st Edition) , 1972.
05. Concepts of Inorganic photochemistry, A. W. Adamson and P D Fleischaves Wiley.
06. Understanding organic reaction mechanisms, A. Jacob, Cambridge Univ. Press, 1997.
07. Introduction to organic chemistry A. Streitweiser, Jr and C. H. Heathcock, Macmillan, 1985.
08. Physical and mechanistic organic chemistry, R.A.Y. Jones, 1st Edn. Cambridge Univ. Press, 1979.
09. Mechanisms of molecular migrations, Vols I and II, B. S. Thiagarajan, 1st Edn. Pergamon Press, Oxford, 1979.
10. P. J. Garratt in Comprehensive organic chemistry, D. Barton and W. D. Ollis, 1st Edn. Pergamon Press, Oxford, 1979.
11. Radicals in organic synthesis, B. Giese, Pergamon Press, 1986.
12. Stereoelectronic effects in organic chemistry, P. Deslongchamps, 1st Edn. Pergamon Press, 1983.
13. Organic photochemistry, J. M. Coxon and B. Halton, 1st Edn, Cambridge Univ. Press, London, 1974.
14. Molecular reactions and photochemistry, C. H. Deputy and D. S. Chapman, 1st Edn. Prentice-hall India, New Delhi, 1972.
15. Stereochemistry of carbon compounds, E. L. Eliel, S. H. Wilen and L. N. Mander, John Wiley & Sons, 1994.
16. Stereochemistry, Potapov, MIR, Moscow, 1984.
17. Stereochemistry, Nasipuri, D, New Age, 1999.
18. Advanced organic chemistry, J. March, 4th Edn. John Wiley, 2008.
19. Organic Chemistry, R. E. Ireland Prentice-Hall India, New Delhi, 1975.
20. Some modern methods of Organic Synthesis, W. Caruthers, Cambridge Uni. Press London, 2nd Edn. 1998.
21. Stereochemistry of organic compounds- Principle and applications, D. Nasipuri, 2nd Edn., New Age International Publishers, 2001.

M.Sc. ORGANIC CHEMISTRY
III SEMESTER

CHORPr-3.5 : ORGANIC CHEMISTRY-IIIA
Teaching hours per week : 04 Credits : 04
Total hours : 64

ORGANIC ESTIMATIONS

01. Estimation of phenol.
02. Estimation of aniline
03. Determination of equivalent weight of acids by silver salt method.
04. Estimation of amino groups by acetylation method.
05. Estimation of nitro group.
06. Estimation of sugars by Fehling's method.
07. Determination of saponification value of oils.
08. Determination of iodine value of oils.
09. Estimation of amino acids.
10. Determination of enol content by Meyer's method.
11. Determination of unsaturation by bromination method.
12. Determination of cholesterol by colorimetric method.

REFERENCE BOOKS:

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| 01. Manual of Organic Chemistry | Dey and Seetharaman. |
| 02. Modern experimental Organic Chemistry | John H. Miller and E. F. Neugil |
| 03. An introduction to practical Organic Chemistry | Robert, Wingrove etc. |
| 04. A Text book of practical Organic Chemistry | A I. Vogel Vol.III |
| 05. Practical Organic Chemistry | Mann & Saunders |
| 06. An Introduction to Practical Organic Chemistry | Robert, Wingrove etc. |
| 07. Semimicro qualitative Organic Analysis | Cheronis, Entrikin and Hodnet |
| 08. Laboratory Manual of Organic Chemistry
London, 3 rd edition, 1996. | R. K. Bansal New PAGE International (P) Ltd. |
| 09. Practical Organic Chemistry
London, 3 rd edition, 1996. | N. K. Visno, New PAGE International(P) Ltd. |

M.Sc. ORGANIC CHEMISTRY
III SEMESTER

CHORT-3.2 : ORGANIC CHEMISTRY-IIIB

Teaching hours per week : 04 Credits : 04

Total hours : 64

UNIT-I

16 hours

CARBOHYDRATES

Definition, classification, constitution of glucose and fructose(open chain and ring structure), inter conversion-aldose to ketose and ketose to aldose, chain lengthening and chain shortening of aldoses, epimerisation.(conversion of glucose to mannose), mechanism of mutarotation, conformations of monosaccharides, anomeric effect, Hudson's rules, epimerization.

Synthesis, industrial and biological importance of glycosides and amino sugars.

Disaccharides - Elucidation of structure of maltose and sucrose.

Polysaccharides-structural elucidation of starch, structure of cellulose, glycogen, importance of starch, cellulose and glycogen as energy and structural materials, structure and importance of chitin and insulin.

UNIT-II

16 hours

AMINO ACIDS, POLYPEPTIDES, PROTEINS AND NUCLEIC ACIDS

Amino acids: Introduction, classification, structure, methods of synthesis (Gabriel phthalimide, malonic ester, Strecker method) and physical properties.

Polypeptides: synthesis of polypeptides- Use of blocking agents, Bruce-Merrifield synthesis of polypeptides.

Proteins: structure of proteins, Primary secondary, tertiary and quaternary structure, end group analysis(Edman's and Sanger's methods), biological importance of proteins.

Nucleic acids: Introduction, classification, components of nucleic acids, structures and synthesis of nucleosides and nucleotides, Watson-Crick model of DNA, role of DNA and RNAs in protein synthesis, genetic code-salient features.

UNIT-III

16 hours

ANTHOCYANINS CAROTENOIDS AND PORPHYRINS

Anthocyanins: Classification, method of isolation, basic structural features of anthocyanins, structural elucidation of cyanin chloride, pelargonin chloride, delphonin chloride. Structural elucidation of quercetin and wedelactone (synthesis not included).

Carotenoids: Methods of isolation. Structural relationship of α -, β - and γ -carotenes. Structure elucidation and synthesis of β -carotene.

Porphyryns: Structure elucidation and synthesis of haemin, chlorophyll-a.

UNIT-IV

16 hours

OILS, FATS AND LIPIDS

Oils, fats and waxes: Definition, chemical composition, chemical properties-hydrogenation, hydrogenolysis, hydrolysis, drying oils, rancidity, analysis of oils and fats-saponification value, iodine and acid value.

Soaps-Manufacture of soaps by hot process, cleansing action. Synthetic detergents, comparison of soaps and detergents, types of detergents (cationic, anionic and nonionic).

Animal and plant waxes-composition, examples.

Lipids: Sphingolipids, phospholipids and glycolipids, naturally occurring fatty acids and their triglycerides, essential fatty acids, unusual fatty acids, methods of isolation: Gunstone's partition method, reactions of fatty acids-Fischer and trans esterification, oxidation and acyl group transfer reactions, analytical values-cetane number, emulsions and biodiesel.

REFERENCE BOOKS:

01. F. A. Carey and Sundberg, *Advanced Organic Chemistry – Part A & B*, 3rd edition, Plenum Press, New York, 1990.
02. F. A. Carey and Sundberg, *Advanced Organic Chemistry – Part A & B*, 3rd edition, Plenum Press, New York, 1990.
03. *Comprehensive Organic Synthesis – B. M. Trost and I. Fleming series*, Pergamon Press, New York, 1991.
04. S. K. Ghosh, *Advanced General Organic Chemistry*, Book and Allied (P) Ltd, 1998
05. *Principles of organic synthesis*, Richard Norman and J. M. Coxon
06. *Disconnection approach*, by Steurt Warren.
07. *Natural products: Their chemistry and biological significance*-J. Mann,
08. R. S. Davidson, J. B. Hobbs, D. V. Banthorpe & J. B. Harborne, Longman, UK,
09. 1994.
10. *Terpenes*, J. Verghese, Tata McGraw-Hill, New Delhi, 1982.
11. *Chemistry of terpenes and terpenoids*, A. Newman, Academic Press, London, 1975.
12. *4. Handbook of naturally occurring compounds Vol. II: Terpenes*, T. K. Davon, I. Scott, Academic Press, NY, 1972.
13. *Natural products chemistry Vol. I & II*, K. Nakanishi, T. Goso, S. Ito, S. Natori & S. Nozoe, Academic Press, NY, 1974.
14. *Total synthesis of natural products Vol. I & VI*, Apsimon, John Wiley, NY, 1973-1981.
15. *Organic chemistry Vol.II*, I. L. Finar, 6th Edn. Longman,1992.
16. *Chemistry of natural products Vol. I & II*, O. P. Aggarwal, Goel Publishing House, 6th Edn. 1982.
17. *Total synthesis of natural products: The chiral approach Vol.III*, S. Hanessian
18. Pergamon Press, 1983.
19. *Total synthesis of steroids*, Akhaun & Titov, Jerusalem, 1969.
20. *Medicinal natural products: A biosynthetic approach*, P. M. Dewick. John Wiley, Chichester, 1997.
21. *The colours of life: An introduction to the chemistry of porphyrins and related compounds*, L. R. Milgrom, Wiley Chichester, 1995.
22. *Spectral data of natural products Vol. I-* K.Yamaguchi, Elsevier Publishing Co, London,1970.
23. *Chemistry of natural products: A unified approach*, N. R. Krishnaswamy, University Press, India, 1999.

M.Sc. ORGANIC CHEMISTRY
III SEMESTER

CHORPr-3.6 : ORGANIC CHEMISTRY-IIIB
Teaching hours per week : 04 Credits : 04
Total hours : 64

MULTISTEP ORGANIC PREPARATION

01. Preparation of 2-bromo-3-phenyl propionic acid from cinnamic acid.
02. Preparation of anthralinic acid from phthalimide.
03. Preparation of p-chlorotoluene from p-toluidine.
04. Preparation of benzophenoneoxime and its rearrangement to benzanilide.
05. Preparation of adipic acid from cyclohexanol.
06. Preparation of methyl red from anthralinic acid.
07. Preparation of benzopinacolone from benzophenone.
08. Preparation of 6,8-nitro-4-methyl-7-hydroxycoumarin from resorcinol.
09. Preparation of benzocaine from p-nitrotoluene.
10. Preparation of β -anilino- β -phenyl propiophenone from acetophenone and benzaldehyde.

NOTE: Two steps(both from same or different reactions) should be given in the examination

REFERENCE BOOKS:

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| 01. Manual of Organic Chemistry | Dey and Seetharaman. |
| 02. Modern experimental Organic Chemistry | John H. Miller and E. F. Neugil |
| 03. An introduction to practical Organic Chemistry | Robert, Wingrove etc. |
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| 07. Semimicro qualitative Organic Analysis | Cheronis, Entrikin and Hodnet |
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London, 3 rd edition, 1996. | R. K. Bansal New AGE International (P) Ltd. |
| 09. Practical Organic Chemistry
London, 3 rd edition, 1996. | N. K. Visno, New AGE International(P) Ltd. |

M.Sc. ORGANIC CHEMISTRY
III SEMESTER

CHORT-3.3 Organic Chemistry-IIIC
Teaching hours per week : 04 Credits : 04
Total hours : 64

UNIT-I

16 hours

ELECTRON SPIN RESONANCE SPECTROSCOPY

Basic principle interaction between spin and magnetic field, origin of spectral line-intensity, width and position of spectral lines, relaxation process, multiplicity in ESR, hyperfine splitting, g-value and factor affecting. Rules for interaction of spectra, zero field splitting and Kramer's degeneracy, John-Teller distortion, isotropic and anisotropic coupling constants, nuclear quadrupole coupling interaction, spin hamiltonian, ESR spectra of radical containing a single set of equivalent protons-methyl, p-benzoquinone, cyclopentadienyl, benzene. ESR spectra of transition metal complexes, applications.

UNIT-II

16 hours

NUCLEAR QUADRUPOLE RESONANCE and MOSSBAUER SPECTROSCOPY

Nuclear quadrupole resonance spectroscopy: Consequence of nuclear spin larger than $1/2$, prolate and oblate nucleus, nuclear quadrupolar charge distribution-theory and instrumentation, relationship between electric field gradients and molecular structure, applications and interpretation of eQq data, effect of crystal lattice on the magnitude of eQq, structural information from NQR spectra.

Mossbauer spectroscopy: Theory and principles, experimental methods, isomer shift, quadrupole interactions, electron density, magnetic interactions; time and temperature dependent effect, application-Iodine trihalides, Prussian blue, trisiron dodecacarbonyl, tin halides, hexacyano ferrate and nitroprussides.

UNIT-III

16 hours

FLAME EMISSION and CHIROPTICAL SPECTROSCOPY

Flame emission spectroscopy: Introduction, types of spectra, types of emission spectra, principle, instrumentation, delivery of sample, flames, excitation profiles in flames, chemical reactions in flames, types of fuels and oxidants, flame temperatures, Total consumption and premix burners, factors influence intensity of emitted radiation, interferences in flame emission spectra, applications both qualitative and quantitative.

Chiroptical spectroscopy: Introduction, Polarized light, Types of polarized light, optical activity, Specific rotation, instrumentation of Polarimeter, optical rotary dispersion (ORD) and Circular Dichroism, difference between CD and ORD, applications of CD and ORD, cotton effect, plane curves, anomalous curves, octant and haloketone rules, applications in the determination of conformation of cyclic and steroidal ketones, application of optical rotation method in the determination of rate constants acid catalyzed muta-rotation of glucose and inversion of cane sugar.

MOLECULAR LUMINESCENCE and PHOTOELECTRON SPECTROSCOPY

Molecular luminescence spectroscopy: Theoretical basis for the fluorescence and phosphorescence. Singlet and triplet excited states. Variables affecting luminescence-quantum efficiency, transition types, structure and structural rigidity, temperature and solvent effects, effect of pH, dissolved oxygen and concentration effect. Excitation and emission spectra us emission spectra. Fluorescence instrumentation- fluorophores and spectrofluorometers. Sensitivity and selectivity. Modification necessary to measure phosphorescence. General scope of applications of luminescence.

Photoelectron spectroscopy: Introduction, principles, chemical shifts photoelectron spectra of simple molecules, X-ray photoelectron and Auger electron spectroscopy, applications.

REFERENCE BOOKS:

01. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash. 4th edition, Tata McGraw-Hill, New Delhi.
02. Introduction to Molecular Spectroscopy, G. M. Barrow, McGraw-Hill, New York.
03. Introduction to Spectroscopy. Pavia, Lampman and Kriz, 3rd edition, Thomson.
04. Spectroscopy, B. P. Straughan and S. Walker, John Wiley & Sons Inc., New York, Vol. 1 & 2, 1976.
05. Vibration Spectroscopy Theory and Applications, D. N. Satyanarayana, New age International, New Delhi.
06. Organic Spectroscopy, William Kemp, 3rd edition, Palgrava, 1991.
07. Optical Method of Analysis, E. D. Olsen, McGraw Hill Inc, 1975.
08. Spectroscopy of organic compounds – P. S. Kalasi, Wiley Eastern Ltd, India 1993.
09. Introduction to instrumental analysis – R. D. Braun, McGraw Hill Book company 1982.
10. Physical methods in inorganic chemistry – R. Drago, East West Pvt. Ltd, 1968.
11. Instrumental methods of chemical analysis – Gurdeep Chatwal and Anand.
12. Organic Spectroscopy, 2nd edition– Jag Mohan, Narosa Publishing House New Delhi.
13. Applications of IR and Raman spectroscopy to coordination and organometallic compounds, K. Nakamoto.



RANI CHANNAMMA UNIVERSITY, BELGAVI
SCHOOL OF BASIC SCIENCES : CHEMISTRY

M.Sc. CHEMISTRY
THIRD SEMESTER

CHEG-3.4 OPEN ELECTIVE : ENVIRONMENTAL CHEMISTRY

Teaching hours per week : 04 Credits : 04

Total hours : 64

UNIT-I

16 hours

Environmental segments, evolution of earth's atmosphere.

Air pollution: Air pollutants, prevention and control, green house gases and acid rain, carbon monoxide, industrial sources and transportation sources.

SO_x- sources, ambient concentration, test methods, control techniques - scrubbing, limestone injection process. Ozone hole and CFC's, photochemical smog and PAN. **NO_x-** sources, ambient concentration, test methods, thermodynamics and NO_x, control techniques.

Particulates: Size distribution, particulate collection - settling chambers, centrifugal separators, wet scrubbers, electrostatic precipitators & fabric filters, catalytic converters for mobile sources, Bhopal gas tragedy.

UNIT-II

16 hours

Hydrologic cycle, sources, chemistry of sea water, criteria and standards of water quality- safe drinking water, maximum contamination levels of inorganic and organic chemicals, radiological contaminants, turbidity, microbial contaminants, public health significance and measurement of colour, turbidity, total solids, acidity, alkalinity, hardness, chloride, residual chlorine, sulphate, fluoride, phosphate and different forms of nitrogen in natural and polluted water, chemical sources of taste and odour, treatment for their removal, sampling and monitoring techniques.

UNIT-III

16 hours

Determination and significance of DO, BOD, COD and TOC, water purification for drinking and industrial purposes, disinfection techniques, demineralization, desalination processes and reverse osmosis.

Radioactive waste management, radionuclides in soil, effects of ionizing radiations-effect on ecosystem, accidents at atomic power plants-Chernobyl disaster, disposal of radioactive liquid wastes, methods of radiation protection.

UNIT-IV

16 hours

Toxic chemicals in the environment, impact of toxic chemicals on enzymes. **Detergents-** pollution aspects, eutrophication.

Pesticides-pollution of surface water. Sewage and industrial effluent treatment, heavy metal pollution. Chemical speciation- biochemical effects of pesticides, insecticides, particulates, heavy metals (Hg, As, Pb, Se), carbon monoxide, nitrogen oxides, sulphur oxides, hydrocarbon, particulates, ozone, cyanide and PAN. Solid pollutants and its treatment and disposal.

Composition of soil - Inorganic and organic components in soil, micro and macro nutrients, nitrogen and sulphur pathways, soil pollution: classification of pollutants and their characteristics, sources, prevention and control, sampling and monitoring techniques.

REFERENCES BOOKS:

01. A.K. De : Environmental Chemistry (Wiley Eastern).
02. S.K. Banerji : Environmental Chemistry (Prentice Hall India), 1993.
03. S.D. Faust and O.M. Aly : Chemistry of Water Treatment, (Butterworths), 1983.
04. G.D. Christian : Analytical Chemistry, (4th Ed.), (John Wiley)
05. Sawyer and McCarty, Chemistry for Environmental Engineering (McGraw Hill) 1978
06. I. Williams, Environmental Chemistry, John Wiley, 2001
07. S. M. Khopkar, Environmental Pollution Analysis, (Wiley Eastern).
08. J.W. Moore: Heavy Metals in Water, (Springer-Verlag), 1984.
09. C. Malcolm, K.Killham and Edwards: Soil Chemistry and its Applications, Cambridge (1993)
10. M. Raymond and J.C. Shickluna: Soils, 5th Ed. (Prentice Hall, India), 1987.