

SEMESTER -3 (OrganicChemistry)

CHE(O) 501

Natural Products and Biomolecules

Unit I : Natural pigment

Natural colouring matter, general classification, method of synthesis, biosynthesis studies of anthocyanins (cyanine) flavones (chrysin) and flavanol (Querecetin)

Porphyrin-structure, spectral properties and synthesis, general and structure determination of Haemoglobin, chlorophyll and Bilirubin.

Unit II : Alkaloids and vitamins

Alkaloids: General biogenetic studies of alkaloids, chemistry of quinine, morphine , reserpine and colchicine

Vitamins : Introduction, synthesis and biochemical function of vitamin B(Thiamine), Vitamin H and α -tocopherol (Vitamin E), vitamin C.

Unit III: Steroids and hormones

General biosynthesis studies of steroids, structure of cholesterol and ergosterol (No synthesis). Stereochemistry of steroids, chemistry of bile acids.

Chemistry of androgens, oestrogens and gestrogens, their synthesis and biochemical role. Adrenocortical hormones, partial synthesis of cortisone.

Unit IV: Terpenoids and carotenoids

Classification, nomenclature, general methods of structure determination, chemistry and synthesis of abietic acid and gibberellic acid (gibberllin-A), farnesol, zingiberine and squalene. Biosynthetic studies on triterpenoids and tetraterpenoides.

Reference books:

1. *Organic chemistry vol I & II (sixth edition) I.L.Finar*
2. *Chemistry of vitamins-S.F.Dyke*
3. *Chemistry of natural products by Bantely, Vol 1-10*
4. *L.J.Wade Jr. Organic chemistry, Prentice nall, England cliffs, 1987*
5. *Chemistry of Natural products vol I & II by O.P.Agrawal*

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CHE(O) 502

Medicinal Chemistry

General classification, structural variations, synthesis and medicinal uses of the following classes of drugs. In addition to the above structure Activity Relationships and Mode of Action should be discussed in classes wherever it is mentioned.

Unit I : Antibiotics

Antibiotics that interfere with the biosynthesis of bacterial cell wall.

- A. The β -lactum antibiotics : Penicillin and cephalosporin
- B. Non lactum antibiotics (only name and structures)
- C. Bacitracin, vancomycin and cycloserine (only name and structures)

Antibiotics that interfere with the protien biosynthesis in microorganisms : non lactum antibiotics, tetracycline, chloroamphenicol

Structure actively relationship (SAR) among penicillinis and tetracyclins

Non classifiable antibiotics (only structure and therapeutic uses)

Synthesis of pencillin V, ampicillin, cephalosporin and chloroamphenicol.

Unit II : Psychoactive drugs

CNS depressant:

- A. General and local anaesthetics
- B. Sedative and hypnotics

Antipsychotic drugs

- A. Antidepressant
- B. Neuroleptics

Synthesis of the following

Thiopental, amobarbital, diazepam, chlorzepan, alprazolam, glutethimide, nikethamide, procaine, lidocaine and dibucaine, Ibuprofen, meclizine sodium, novalgine, pethidine

Unit III: Antimalarial and Antituberculosis drugs

Antimalarials: Modern chemotherapy of malaria, 4-amino and 8-amino quinolins, 9-amino acridine.

Synthesis of mefloquine, chloroquine, primaquine and daraprim

Mode of action of antimalarial agents

SAR of antimalarial agents

Anti tuberculosis: Synthesis of only the following drugs:

Isoniazid (INH), Ethionamide, Ethambutol, DDS (Dapsone)

Unit IV :Cardiovascular, diuretics and hypoglycemic agents

Synthesis of amyl nitrate, diltiazem, atenolol, methyl dopa, tolbutamide, chlorpropamide, glibenclamide, acetazolamide, chlorothiazide, furosemide and ethacrynic acid

Reference books:

1. *Burger's medicinal chemistry and drug design (5/e) 1997, vol 1 to 5 edited by Manfred E.Woltt (John Wiley and Sons Inc. New York)*
2. *Principles of medicinal chemistry by William A. Foye (ed), Lea and Febiger (Philadelphia)*
3. *Principles of medicinal chemistry vol I & II (5/e) F.S.Kadam, K.R. Mahadik and K.G. Bohra (Nirali publication)*
4. *Medicinal chemistry by Ashutosh Kar*
5. *The organic chemistry of drug synthesis vol I, II and III (1980) ed by D. Lednicer and L.A. Mitscher (John Wiley and Sons, New York)*
6. *Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry (5/e, 1982) by Robert Doerge (J.B. Lippincott Company, Philadelphia/ Toppan Co. Ltd, Tokyo)*
7. *Topics in medicinal chemistry vol I & II by Rabinowitz Myerson (Interscience 1968)*
8. *The pharmaceutical basis of therapeutics by Geoman and Gilman (McMillan Co.)*

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Organic Spectroscopy

Unit I :UV & IR

UV: Electronic transitions, chromophores, auxochromes, bathochromic and hypsochromic shifts, solvent effects, Woodward-Fieser rules for dienes, enones and aromatic compounds applications of UV., instrumentation.

I.R. Vibrational transitions, important group frequencies, factors affecting I.R. group frequency, applications of I.R. instrumentation

Unit II : NMR

Elementary ideas of NMR integration, chemical shifts, Factors affecting, chemical shifts, coupling (first order, analysis) instrumentation and principles and instrumentation, FT, chemical shifts, spin-spin coupling different spin systems, mechanism of spin coupling. E.g. AB, ABX, factors affecting vicinal and geminal couplings, rate processes, long range couplings, spin decoupling, shift reagents, solvent shifts, nuclear Overhauser effect. 2D NMR (COSY and HETCOR) applications.

Unit III: C¹³ NMR and Mass spectrometry

C13 NMR: elementary ideas, instrumental problems, chemical shift features of hydrocarbons, effect of substituent on chemical shifts olefinic, acetylenic, aromatic and carbonyl carbons, effects of coupling
Mass spectrometry: theory, instrumentation, modes of ionization, types of detectors, modes of fragmentation. Different types of ions, molecular ions, isotopic peaks, factors controlling fragmentation, hyphenated mass spectroscopy techniques.

Unit IV:

Structural elucidation of drug molecules based on joint application of UV, IR, PMR, CMR and mass spectroscopy.

Reference books:

1. *Spectroscopic methods in organic chemistry*, D.H. Williams and Tan Fleming
2. *Spectrometric identification of organic compounds*, T.C. Morrill R.M. Silverstein and G. Bassler, 6th edition, John Wiley and sons
3. *Introduction to spectroscopy*, D.L. Pavia, G.M. Lampman and G.S. Kriz, 3rd edn, Harcourt college publishers.
4. *Organic spectroscopy* by W. Kemp
5. *Organic spectroscopy* by P.S. Kalsi

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Industrial Chemistry

Unit I : Basic principles

Basic chemical data, batch versus continuous operation, design, flow charts, chemical process selection, safety, hazardous, fire toxic materials, research and development patents, good manufacturing practice and laboratory practice.

Unit II: Unit processes in organic chemistry

Nitration, sulfonation, halogenation, amination and alkylation methods and industrial chemicals derived from benzene, naphthalene and anthracene using unit process.

Unit III

Green chemistry -12 principles of green chemistry

Green solvents- aqueous phase reactions Wurtz reaction, Wittig-Horner reaction,

Michael reaction

- Solid phase reactions: halogenation, aldol condensation, Grignard reaction.

- Ionic liquid as green solvent- hydrogenation, Diels-Alder reaction, o-alkylation and N-alkylation

Green catalysts of green reagents (introduction)

Unit IV

Manufacture and uses of

- Agrochemicals (insecticides, fungicides, plant nutrients and plant hormones, Weedicides, pesticides)

- Unit operations

Reference books:

1. *Unit processes in organic synthesis* by P.H. Groggin
2. *Industrial Chemical process* by R.N. Shreve
3. *Riegels handbook of industrial chemistry* ed by James and Kent
4. *Dryden's outlines of chemical Technology* M. Gopal Rao

SEMESTER -3
Organic Chemistry - Practicals
CHE(O) 505 & 506 PR

Preparation of industrially important compounds by following name reactions (mechanism, purification and characterization of the synthesized compounds)

1. Sandmeyer reaction
2. Pechmann reaction
3. Skraup synthesis
4. Riemer-Tiemann reaction
5. Kolbe-smith reaction
6. Claisen-smith synthesis
7. Hoffman reaction
8. Diels-alder reaction
9. Green –bromination

Estimation

1. Drug assay (estimation of sulphadiazine)
2. Non-aqueous titration
3. Nitrite value
4. Drug dissolution

Reference books:

1. *Quantitative analysis by Arthur I. Vogel*
2. *Quantitative analysis by V.K. Ahluwalia*
3. *Quantitative analysis by Mann and Sanders*