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 (chryosin) 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 gestogens, 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, zingeberine 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  
5. Chemistry of Natural products vol I & II by O.P.Agrawal

SEMESTER -3 (OrganicChemistry)  
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 protein 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, chlorozepan, alprazolam, glutethimide, nikethamide, procaine,
lidocaine and dibucaine, Ibuprofin, meclofenate sodium, novalgin, pethidine

Unit III: Antimalarial and Antituberculosis drugs
Antimalarials: Modern chemotherapy of malaria, 4-amino and 8-amino quinolins, 9-amino acridine.
Synthesis of mefloquines, chloroquine, primaquine and darpamil
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, diltiazim, atenolol, methyl dopa, tolbutamide, chloropropamide,
glibenclamide, acetazolamide, chlorothiazide, furosemic and ethacrylic 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 Mc. New york)
2. Principles of medicinal chemistry by William A. Foye (ied), lea and febiys (Philadelphia)
   (Nirali publication)
4. Medicinal chemistry by ashutosh kar
   mitscher (Johyn wiley and sons, New york)
   Robert Doerge (J.B. lippincoff company, philadelphia/ Toppan co.Ltd. Tokyo)
7. Topics in medicinal chemistry vol I & II by rabinowitz Myerson (interscience 1968)
8. The pharmaceutical basis of theraperutics by Geoman and Gilman (Mcmillian co.)

SEMESTER -3 (OrganicChemistry)
CHE(O) 503
Organic Spectroscopy

Unit I :UV & IR
UV: Electronic transitions, chromophores, auxochromes, bathochromic and hypsochromic shifts,
solvent effects, wood ward fieser rules for dienes, enones and aromatic compounds applications of
U.V., instrumentation.
I.R. Vibrational transitions, important group frequencies, factors affecting I.R. group frequency,
aplications 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.q. 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: C$^{13}$ NMR and Mass spectrometry

C$^{13}$ 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 Tanfleming
4. Organic spectroscopy by W.Kemp
5. Organic spectroscopy by P.S.Kalsi

SEMESTER -3 (OrganicChemistry)
CHE(O) 504
Industrial Chemistry

Unit I: Basic principles
Basic chemical data, batch versus continuous operation, design, flow charts, chemical process selection, safely, 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, witting-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
-Argochemics (insecticides, fungicides, plant nutrients and plant hormones, Weedicides, pesticides)
-Unit operations
Reference books:
1. Unit processes in organic synthesis by P.H.Groggins
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 sulpha drug)
2. Non-aqueous titration
3. Nitrite value
4. Drug dissolution

Reference books:
1. Quantitative analysis by Arther I.Vogel
2. Quantitative analysis by V.K.Ahuwalia
3. Quantitative analysis by Mann and sanders
SEMESTER -4 (Organic Chemistry)
CHE(O) 507
Advanced Organic Chemistry

Unit I: Pericyclic reactions
Introduction, classification of pericyclic reactions, stereochemistry, molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system, F.M.O. and PMO approach to cycloaddition and electrocyclic reactions; Generalisation of woodward-Hoffmann rule, sigmatropic rearrangement-suprafacial and antarafacial shifts of H. Stereoselectivity in sigmatropic rearrangement, enantioselectivity in pericyclic reactions.

Unit II: Conformational analysis
Confirmation at cyclic systems: Confirmation of cyclohexane, mono and disubstituted cyclohexane, heterocyclic compounds, five and six membered heterocycles, stereoelectronic effects, fused bicyclic system, decalin, dodecalin, polycyclic system, perhydrophenanthrene, bridged systems-conformation of sugars, steric strains due to unavoidable crowding, stereochemistry of the compounds containing nitrogen, sulphur and phosphorous.

Unit III: Oxidation
Introduction, different oxidation processes, hydrocarbons-alkenes, aromatic rings, saturated C-H group (activated and unactivated), alcohols, diols, aldehydes, ketones, amines, hydrazine and sulphides.

Unit IV: Reduction
Introduction, different reductive processes, hydrocarbons-alkanes, alkenes, alkynes and aromatic rings Carbonyl compounds- aldehydes, ketones, acids and their derivatives, epoxides, nitro, nitroso, azo and oxime groups, Preparation and properties and application of pd and Ti compounds as organometallic agents

Reference books
1. Advance organic chemistry by Jerry March
2. Advance organic chemistry by Carey and Sundberg,
3. Advance organic chemistry by Francis A. carey

SEMESTER -4 (Organic Chemistry)
CHE(O) 508
Advanced Organic Synthesis

Unit I: Protection of groups
Principle of protection of hydroxyl, amino, carbonyl, carboxylic acid with different reagents and their deprotection, synthetic equivalent groups, synthetic analysis and planning, control of stereochemistry.

Unit II: Disconnection approach
An introduction to synthesis, and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis one group C-X and two group C-X disconnections, chemo-selectivity, reversal and polarity.

Unit III: One group C-C disconnections
Alcohols and carbonyl compounds, region-selectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

Unit IV: Ring synthesis
Saturated heterocycles, synthesis of 3, 4, 5, and 6-membered rings, aromatic heterocycles in organic synthesis

Reference books
SEMESTER -4 (Organic Chemistry)
CHE(O) 509
Bio organic Chemistry

Unit I : Water and vitamins

Water –interaction among biomolecules in aqueous systems, buffering against pH changes, in biological systems, participation of water in biological reactions.
Vitamins-classification, introduction, chemistry, absorption transport, mobilization and biochemical functions of Vitamins A, D, E, K, C, B, B2, B6, H and folic acid

Unit II : Proteins and enzymes
Proteins: properties and conventions of common amino acids, stereoisomerism in α -amino acid, peptides: formation, compositions and sizes of protein separation, purification and characterization, sequencing of peptides, sanger’s method, edman degradation, outline of other methods, protein sequences and evolution. Oxygen binding proteins, haemoglobin and myoglobin in oxygen transport and storage.
Enzymes: classification, nomenclature and extraction factors affecting catalytic activity and specificity in action, regulation of enzyme activity, enzyme inhibition, illustrative enzymatic reactions using chymotropsin, hexokinase, enolase and lysozyme
Unit III: Carbohydrates and nucleic acid
Carbohydrates: classification and stereochemistry, biologically important hexose derivatives, nomenclature of disaccharides, structure and role of some homo and hetero polysaccharides, glucococonjugates: proteoglycans, glycoproteins and glycolipids
Nucleic acid: compounds of nucleic acids, nomenclature of nucleotides, nucleosides, structure of DNA and structure of RNA

Unit IV: Lipids
Nomenclature, structure and physical properties of some naturally occurring fatty acids, triacelglycerol and waxes as sources of stored energy, insulation of water repellants, types of membrane lipids, introduction to glycerophospho lipids, galactolipids, sphingo lipids, phospholipids and sterols, bile acids.

Reference books:

1. Principles of biochemistry – Donald J. Voet, Judish G. Voet, charlotte w. pratt (John willey and sons)
2. Lehninger principles of biochemistry- David L.Nelson and Michael M.wx (Palgrave Macmillan / w.h. freeman company new york)

SEMESTER - 4 (Organic Chemistry)
CHE(O) 510
Selected topics in Medicinal Chemistry

Unit I: Drug design:
Introduction, naming of organic medicinal compounds, literature of medicinal chemistry, development of new drugs, procedure followed in drug design, concept of lead compound and lead modification, prodrugs, soft drugs, phase I, II and III clinical trials, structure activity relationship, theories of drug activity: occupational theory, rate theory, induced fit theory, quantitative structure activity relationship, history and development of QSAR. Concept of drug receptors, elementary treatment of drug receptor interactions, physio chemical parameters lipophilicity, partition coefficient, electronic ionization constant, concept of 3-D QSAR.

Unit II: Pharmacokinetic and pharmacodynamics
Pharmacokinetics: introduction to drug absorption, distribution, metabolism, elimination. important pharmacokinetic parameters in defining drug deposition and in therapeutics, uses of pharmaceutics in drug development process

Unit III:
A. Dosage forms, Quality control and application of computers in chemistry
Dosage forms, types of dosages, different roots of administration, quality control of drugs pharmacopias, modern methods of pharmaceutical analysis.
B. Computer in chemistry
Use of computer in chemistry and industry
Important websites for data search chemistry
Information about online journals for chemistry

Unit IV: Medicine
Overview, Medicinal use of nanomaterials-Drug delivery
Protein and peptide delivery –cancer, surgery, visualization, nanoparticle targeting
Medical application of molecular nanotechnology-nanorobots, cell repair machines, nanonephrology.
References Books:
5. QSAR: Hansch analysis and related approaches By Hugo Kubinyi

SEMESTER -4 (Organic Chemistry )
CHE(O) 511 & 512 PR
dissertation/industrial training