# SYLLABUS FOR M.Sc CHEMISTRY

Specialisations (1) Organic Chemistry and (2) Chemistry and Analysis of Foods, Drugs and Water,- of the Department of.Organic Chemistry, and Chemistry and Analysis of Foods, Drugs and Water, Andhra University, Visakhapatnam - 530 003.

## I - SEMESTER

Course/Paper - III: Organic Chemistry - 1

### UNIT - I

Structure and reactivity: Localised and delocalised covalent bond - Concept of resonance and aromaticity - Huckel's rule for aromaticity in benzenoid and non-benzenoid compounds, anti-aromaticity and homo-aromaticity. Nature of reaction energy and kinetic considerations - types of organic reactions - reagents - reactive intermediates. Their formation and stabilization - inductive and mesomeric effects.

### UNIT - II

Stereochemistry and stereoisomerism.Conformational isomerism and analysis in acyclic and simple cyclic systems - substituted ethanes, cyclopentane, cyclohexane cyclheptane, cyclo octane and decalins, optical isomerism - optical activity - molecular dissymmetry and chirality - elements of symmetry.

Fisher's projection D,L. and R,S. configurations - relative and absolute configurations optical isomerism due to asymmetric carbon atoms - optical isomerism in biphenyls, allenes and spirans - optical isomerism of nitrogenous compounds racemisation and resolution - geometrical isomerism and E,Z configurations, properties of geometrical isomers.

### UNIT - III

Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems -

Pyridine, quinoline, Isoquinoline, . Indole, Benzofuran, Benzothiophene - Pyrazole, Imidazole, Oxazole, Isoxazole, Thiazole, Isothiazole, Pyridazine, py.rimidine and Pyrazine.

### UNIT - IV

Chemistry,,of some typical natural products. A study of the following compounds involving their isolation, structure elucidation, synthesis and biogenesis - flavonoids - quercetin, cyanidin and genestein, terpenoids, $\alpha$- terpeneol a $\alpha$ - pinene, campihor, farnesol.

II SEMESTER

Course/Paper - III: Organic Chemistry - 2 ,

UNIT - I

Aromatic substitution reactions - electrophilic, nucleophilic and through benzynes - radical substitution of arenes - orientation of nucleophilic substitution at a saturatéd, carbon, SN1, SN2, SNi reactions -effect of structure, nucleophile, leaving group, solvent. Additions involving electrophiles, nucleophiles and free radicals.

. Elimination reactions - El, - E1CB, E2 reactions – elimination versus substitution reactions.

U.NIT - II

Mechanism of some name reactions: Aldol, Perkin, Benzoin, Cannizaro, Wittig, Grignard, Reformatsky - Meerwein, Hoffmann Claisen and Favorsky rearrangements. Hydroboration - openauer oxidation, clemmensen reduction - Meerwein - Pondorf and verley and Birch reductions. Stork enamine reactions, Michael addition, Mannich Reaction, Diels - Alder reaction, Ene - reaction, Bayer - Villiger Reaction.

UNIT - III

Spectra and structure - application of organic spectroscopy UV, IR, $^{1}$HNMR and Mass spectral data.

UNIT - IV

Isolation, structure elucidation and synthesis of alkaloids; atropine, nicotine, and quinine. Purines - Caffeine configuration and ring structures of glucose and fructose, anomeric effects.

Text books:


1. Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL finar ELBS.

2. Organic Chemistry (fifth Edn., ) by Morrison and Boyd, PHI, India.

3. Organic Chemistry (fifth edition)by Francis A. Carey Tata Mc Graw Hill publishing company Limited, New Delhi.

4. Reaction Mechanism in Organic Chemistry by Mukherjee Sirigh, NTerniitarr, Indiar

5. A guide book to mechanism in Organic Chemistry by Peter Sykes, ELBS.

REFERENCE BOOKS:

Advanced organic chemistry by Jerry March (4th Edition)Wiley Eastern. .

Chemistry of Natural Products, K.W.Bentley by stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.

Stereochemistry of Organic compounds by D. Nasipuri.

Chemistry of Natural products by R.S. Kalsi Kalyani Publishers. 1983.

## SYLLABUS FOR M.Sc FINAL ORGANIC CHEMISTRY

### III - SEMESTER

Paper I - Organic Reaction Mechanisms-I and pericyclic reactions

UNIT-I

Aliphatic Nucleophilic Substitution Mechanisms Nucleoyhilic substitution: Substitution reactions of ambident nucleophiles, neighbouring group participation of O, S, N, halogens, aryl groups, alkyl and cycloalkyl groups in nucleophilic substitution reactions. Sigma, Pi bond participation in acylic and bicyclic systems (Non- classic carbocations)' Substitution at allylic, trigonal and Vinylic carbons, hydrolysis of esters, Meyer's aldehydes, ketones and carboxylic acids, alkylation with triakyl boranes.

Aliphatic Electrophilic substitutions: $SE^1$ $SE^2$ and $SE^i$ mechanisms hydrogen exchange, migration of double bonds, halogenation of aldehydes, ketones, acids, acylhalides sulphoxides and sulphones, aliphatic diazonium coupling, nitrosation at Carbon and nitrogen diazo transfer reaction carbene and nitrene insertion, formation of sulphur yield, metalation with organometallic compounds and with metals. Decarboxylation of aliphatic acids. Haloform reaction and Haller-Baner reaction.

UNIT-II

Aromatic nucleophilic substitution: A general introduction to different mechanisms of aromatic substitution SN Ar, AN and aryne Von richter rearrangement, sommlet, Hauser rearrangement Smiles rearrangement.

Radical substitution Mechanism: Reaction at Sp3 carbon: Reactivity in aliphatic substrates reactivity at bridged position, reactivity at Sp2 carbon. Reactivity in aromatic substrates, neighbouring group asšistance in free radical reactions, effect of reactivity in the attacking radical effect of solvent on reactivity halogenation at an alkyl carbon and allylic carbon, hydroxylation at aromatic carbon by means of Fenton's reagent, oxidation of aldehydes to carboxylic acids, formation of cyclic ethers with Pb(OAC)4 Reed reaction, sandmayer reaction, kolbe reaction and Hunsdiecker reaction.

UNIT-III

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene, allyl system, classfication of pericyclic reactions FMO approach, Woodwrd- Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions.

Electrocyclic Reactions: Conrotatory and disotatory motions (4n) and (4n+2), allyl systems and secondary effects.

Cycloadditions: Antarafacial and suprafacial additions, notation. of cycloadditions, (4n) and (4n+2) systems with a greater emphasis on (2+2) and (4+4) - cycloadditions, (2+2) - additions of ketones secondary effects of substitutes on the rates of cycioadditions and chelotropic reactions.

UNIT-IV

FMO approach and perturbation of molecular (PMO) approach for the explanation of sigma tropic rearrgements under thermal and photochemical conditions. suprafacial and antarafacial shifts of H Sigmatropic shift involving carbon moieties, retention and inversion of configurations, (3.3) and (5.5) sigmatropic rearrangements detailed treatment of Claisen and Cope rearrangements fluxional tautomerism, aza-Cope rearrangem'ents and Barton reaction.

1) Advanced Organic Chemistry: Reactions Mechani;sms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
3) Pericyclic reactions by S.N. Mukharji, Mcmilan.

Reference Books:

1) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.
2) The modern structural theory in Organic ChAmistry by L.N.Ferguson, Pretice Hall
3) Physical Organic Chemistry by jack Hine, Mc. Graw Hill

**III - SEMESTER**

Paper II- Organic Spectroscopy - I

UNIT-I

Infrared spectroscopy: Units of frequency wave length and wave number, molecular vibrations, factors influencing vibrational frequencies, the IR spectrometer, sampling techniques, characteristic frequencies of organic molecules and interpretation of spectra.

UNIT-II

Ultraviolet spectroscopy: Introduction. the absorptioÁ laws, measurement of the spectrum, chromophores, standard works of reference, definitions, applications of UV spectroscopy to Conjugated dines, trienes, unsaturated carbonyl compounds and aromatic compounds.

UNIT-III

Nuclear Magnetic Resonance Spectroscopy (Proton and Carbon -13 NMR)

The measurement of spectra: the chemical shift: the intensity of NMR signals and integration factors affecting the chemical shifts: spin-spin coupling to 13C IH-IH first order coupling: some simple IH-IH splitting spatterns: the magnitude of IH-IH coupling constants:

Mass spectroscopy: Basic Principles: instrumentation: the mass spectrometer, isotope abundances; the molecular ion, metastable ions

UNIT-IV

Separation techniques; solvent extraction Chromatography – Paper – thin layer partition – column chromatography. Electrophoresis.

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Text books:

1) Spectroscopic Methods in Organic Chemistry. Forth Edition D.M. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990. For all spectral methods except ORD and CD and ESR.

2) Organic Spectroscopy, Second Edition, W.Kemp, ELBS Macmillan, 1987 for ORD and CD and ESR.

Books in Reference:

1) Book 2 mentioned above.

2) Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.

3) Spectrometric identification of Organic Compounds, Fourth Edition, R.M.

Silverstein: G.C.Vassiellr and T.C. Merill, Johne Willey, Singapore, 1981.

4) For ORD and CD "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in "Elucidation of Organic structures by Physical and Chemical Methods" Part I (Eds) K.W. Bentley and G.W.Kirty John Wiley, 1972, Chapter VIII (only those aspects mentioned in the syllabus).

## III - SEMESTER
## Paper III -- Organic Synthesis-I

### UNIT-I

Formation of Carbon-Carbon sing;le bonds: alkylations via enolate the enamine and related reactions umplong (dipole inversion) - The aldol reaction- applications of organ palladium, organo nickel and organo copper reagents , applications of thicarbonions- selenocarbonions and sulphur yields, synthetic applications of carbenes and carbenoids.

### UNIT-II

Formation of carbon-carbon double bonds: Elimination reactions Pyrolytic, syneliminations, sulphoxide-sulphonate rearrangement the witting reaction-alkenes form arylsluphonyl-hydrazones-claisen rearrangement of allyl vinylethers.

### UNIT-III

Methods of polymerization (a) Addition polymerization (b) Condensation polymerization and (c) Radical polymerizations (two examples of each method). Reactions of unactivated carbon-hydrogen bonds: The HoffmannLieffier- Freytag reaction-the Barton reaction-Photolysis of organic hypothalites.

### UNIT-IV

Synthetic applications of organobornaes

Organoboranes: Preparation of Organobornaes viz hydroboration with BH3-THF, dicylohexyl borane, disiamyl borane, theryl borane, 9-BBN and disopincamphlyel borne, functional group transformations of Organo boranes-Oxidation, protonolysis and rearrangements. Formation, of carbon-carbon-bonds viz organo boranes carbonylation, the cyanoborate process and reaction of alkenyl boranes and trialkenyl borates.

Textbooks:

1) Some Modem Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
2) Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.

Books for Reference:

1) Modern Synthetic Reactions, Herbet O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
2) Organic Synthesis viz Boranes, Herbet C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely & Sons, New York, 1975.

## III – SEMESTER

### Paper IV- Natural Products and Biopolymers-I

Study of isolation, structure, stereochemistry, synthesis, biogenesis and biological properties of the following classes of natural products from plant, animal, and microbial sources and biopolymers.

UNIT-I

Acetogenins and shikimates:

Microbial metabolites: Pencillin G, Cephalosphorin-Ö and streptomycin.

UNIT-II

Terpenes: Forskolin, taxol and azadirachtin.

UNIT-III

Alkaloids: Morphine, reserpine and vincristine

UNIT-IV

Biopolymers:
Peptides: a.-Aminoacids, their general properties and synthesis, Synthesis of peptides by Merrifield solid phase synthesis. Chemistry of oxytocin and dolastain-10.

Note: The scope of the topics of this unit, i.e., Unit IV is limited to the material contained in the books by Finar and Heathocock mentioned below.

Reference Material:

1) Organic Chemistry, Volume 2. Stereochemistry and chemistry of natural products, I.L. Finar, 5* Edition, ELBS, 1975 (overall and for Unit IA., rnorphine

and Unit IV).

2) Chemical Aspects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996

3) Chemistry of Natural Products: A Unified Approach, N.R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999. (Overall and for certain aspects of, azadirachtin, morphine, reserpine,).

4) Introduction to Organic Chemistry, A Streitweiser, CH Heathcock and E.M/ Kosover IV Eeition, Me.Milan, 1992. (For Merrifield synthesis of peptides and also for other aspects of Unit IV),

5) Prirnary literature, For Unit 1B, forskolin, taxol, azadirachtin, Unit III (minus morphine) and dolastatin-10, Details and copy of the relevant material are

available with the Department of Organic Chemistry, FD & W, Andhra University, Visakhapatnam.

Details of Primary literature:

Nomenclature:

Structure: TL, 1969, 5185.

Forskolin: TL, 1977, 19, 1669; IJC, 1977. 15B, 880(structure) Tetrahedron, 48, 963, 1992 (synthesis).

Taxol: JACS, 1971, 93, 2325 (structure), Tetrahedron, 1996, 45, 14081-102, 14103-146, 14147-176 (synthesis).

Azadirachtin: JCS Perkin I, 1972, 2445; JACS, 1975, 97, 1975; JCS Chem Comm. 1985, 968, ibid, 1986, 46; Compendium of Indian Medicinal plants, Vol. 4, 1985-88, R.P. Rastogi and B.N. Malhora, CDRI & Publications & Information Directorate, New Delhi, pp. 87-95.

Reserpine: Alkaloids, Manske, Vol.VIII, 1065,pp. 287-335.

Vincrisline: JACS. 1964,86,1441, Alkaloids, Manske, Vol.VIII, 1965, pp, 269-285.

Dolastatin-10: JACS, 1987,109,6883(Structure), ibid, 1989, 111, 5463, JCS, Parkin 1, 1996,859(synthesis).

SYLLABUS FOR M.Sc FINAL ORGANIC CHEMISTRY

IV - SEMESTER

Paper I - Organic Reaction Mechanisms-II and organic photochemistry

UNIT-I

Addition Elimination Mechanisms: (a) Addition to carbon multiple bonds- Addition reactions involving electrophiles, necleophiles and free radicals, cyclic mechanisms, orientation and stereochemistry, hydrogenation of double and triple bonds, hydroboration, birch reduction. Michael reaction, addition of oxygen and N,.04; (b) Addition to carbon-hetero atom multiple bonds: Mannich reaction AH reductions of Carbonyl compounds acids, esters, nitrites, addtion of Grignard reagents, Reformatsky reaction, Tollen's reaction, witting reaction, Prins reaction: (c) Elimination reactions: Stereochemistry of eliminations in acyclic and cyclic systems, orientation in eliminations - Saytzeff and Hoffman elimination propolitic elimination.

UNIT-II

Rearrangements: Classfication and general mechanistic treatment of nucleophilic, free radical and electrophilic rearrangements, Wagner - Meerwein and related reactions Tiffeman Demzanox rearrangement, a- ketone arrangement, Neber, Hofmann, Bayer- villiger, stevens wittig rearrangements.

UNIT-III.

Organic Photochemistry:

Photoehemical energy plank Condon Principle, Jabionski diagram singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield, experimental methods of photochemistry.

Photochemistry of carbonyl compoundsn- $n-\pi$, $\pi=\pi*$ transitions Norrish type I and Norrish type II cleavages, patterno-Buchi reaction.

UNIT-IV

Photoreduction photochemistry of enone - Hydrogen abstraction, rearrangement of $\alpha$ ; ß - unsaturated ketones and cyclohexadienes, Photochemistry of p- Benzoquinones, photochemistry of unsaturated systems - Olefins, cis trans Isomerisation and dimerization hydrogen abstractions

and, addition acetylenes dimerisation, dienes - Photochemistry of 1,3 butadienes (2+2) additions leading to cage structures photochemistry .of cyclohexadienes.

Photochemistry of aromatic compounds - Excited state of benzene its 1,2-1,3 1-4 additions, photo Fries rearrangements, photofries reactions of anilides, photosubstitution reactions of bermene derivatives.

Photochemistry of pyridinium yields, pyrolysis of nitrites esters and barton reaction. -

Text books:

1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Me.Graw Hill and Kogakush.

2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.

Reference Books:

1) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.

2) The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall
3) Physical Organic Chemistry by jack Hine, Mc. Graw Hill

## IV - SEMESTER
## Paper II- Organic Spectroscopy -- II

UNIT-I

Optical rotatory dispersion and circular dichroism: Phenomena of ORD and CD. Classification of ORD and CD Curves; Cotton effect curves and their application to stereochemical problems; the Octant rule and its application to alicyclic ketones.

UNIT-II

Improving the NMR spectrum: the mean, pulse experiment, new techniques in FT NMR.spectroscopy: the separation of chemical shift and coupling on to different axes (2D-

NMR,cosy), spin decoupling, the nuclear over hauser effect associating the signals from directly bonded 13 C arid IH.

ESR Derivative curves: values and hyperfine splitting.

UNIT-III

Fragrmentation processes; fragmentation associated with functional groups; rearrangement and mass spectra of some chemical classes.

Structural elucidation of Organic compounds by a combined application of the special methods of Units 1-III.

UNIT-IV

Separation Techniques; Instrumentation – Gas Chromatography, High performance Liquid Chromatography, X – Ray diffraction (XRD)

Text_books:

1) Spectroscopic Methods in Organic Chemistry. Forth Edition D.M. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990. For all spectral methods except ORD and CD and ESR.

2) Organic Spectroscopy, Second Edition, W.Kemp, ELBS Macmillan, 1987 for ORD and CD and ESR.

Books in Ileterence:

1) Book 2 mentioned above.
2) Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.

3) Spectrometric identification of . Organic Compounds, Fourth Edition, R.M. Silverstein; G.C.Vasslellr and T.C. Merill, Johne Willey, Singapore, 1981.For ORD and CD "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in "Elucidation of Organic structures by Physical and Chemical Methods" Part I (Eds) K.W. Bentley and G.W.Rirty John Wiley, 1972, Chapter VIII (only those aspects mentioned in the syllabus).

IV-SEMESTER

Paper III - Organic Synthesis-II

UNIT-I

Organo silanes. Synthetic applications of trimethylsilyl chloride dimethyl-t-butylsilyl chloride, trimetthylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate, synthetic applications of·. silyl carbanion and B-silyl carbonium ions.

Phase transfer catalysis-Principle and applications.

UNIT-II

Oxidation: Oxidations of hydrocarbons, aikenes, alcohols aldehydes and ketones oxidative coupling reactions. Use of Pb (OAC)4, NBs.. CRO3, SeO2, NinO2 Dc- alkoxyluphonium yields, KMnO4, OsO4, peracids and Ti (III) nitrate.

UNIT-III

REDUCTION: Catalytic hydrogenation (homogeneous and heterogeneous), reduction by dissolving metals. reduction by hydride transfer -reagents, reduction with hydrazine and diamide, selectivity in reduction of nitroso and ritro compounds, reductive cleavage.

UNIT-IV

Design of Orgauie Synthesis: Retrosynthesis the disconnection approach-basic principles convergent and linear synthesis.

Textbooks:

1) Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.

2) Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.

Books for Reference:

1) Modern Synthetic Reactions, Herbet O. Horase, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.

2) Organic Synthesis viz Boranes, Herbet C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely &. Sons, New York, 1975.

IV - SEMESTER

Paper IV- Natural Products and Biopolymers-Il

St.udy of isolation, structure, stereochemistry, synthesis, biogenesis and biological properties of the following classes of natural products from plant, animal, and microbial sources and biopolymers.

UNIT-1

Acetogenins and shikimates:
Prostaglandin 15 R F GAy podophyllotoxin, etoposide and rotenone.

UNIT-II

Terpenes and Ste.roids:
cholesterol, progesterone And β- amyrin

UNIT-III

Alkaloids:
strychnine, colchicines and camptothecin.

UNIT-IV

Nucleic acids: Basic concepts of the structures of RNA and DNA and their hydrolysis products nucleotides, nucleosides and heterocyclic bases.

Reference Material:

1) Organic Chemistry, Volume 2, Stereochemistry and chemistry of natural products, I.L. Finar, 5th Edition. ELBS, 1975 (overall and for Unit IA., cholesterol, progesterone, and Unit TV).

2) Chemical A spects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996

3) Chemistiy of Natural Productc· . A Unified Approach, N.R. Krishnaswamy, Universe.y Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999. (Overall and for certain aspects of rotenone, β.-amyrin, strychnine, and colchicines).

Primary literature, For Unit 1,Unit III (minus morphine) and Details and copy of the relevant material are available with the Department of Organic Chemistry, FD & W, Andhra University, Visakhapatnam.

M.Sc. Chemistry (Final Year)

Specialisation: Chemistry and analysis of Foods, Drugs and Water syllabus

III SEMISTER

Pa er -I: Chemistry of Drugs -I

Unit-I : Basic consideration of drugs : Classification , nomenclature, metabolism .

Development of drugs : Sources , Genesis of drugs - molecluar modification general and special processes: prodrugs (prolongation of action ,shortening of action, drug localisation, transport regulation, adjunct to pharmaceutical formulation); rational drug design.

Theoritical aspects of drug action: Structure -activity, Physico-chemical parameters and pharmacological activity; drug receptors; mechanism of drug action.

Unit-II : Drugs affecting the central nervous system:

Sedatives and hypnotics -Barbiturates (structure-activity relationship, metabolism); benzodiazepines( structure -activity relationship , metabolism); miscellaneous compounds.

Synthesis of phenobarbital, hexobarbital nitrazepam and oxazepam.

Anaesthestics : General anesthetics; local anesthetics- Modeof action, structure-activity relationships.

Synthesis of methohexital and chloro-procaine.

Analgesics: synthetic analgetics, structure - activity relationships, antipyretic analgetics, ant- inflammatory analgetics, metabolism and mode of action.opioid analgesics and antagonists.

Synthesis of meperidine , methadone and 6,7 -benzomorphans.

Tranquilizers : phenothiazine dervatives - stucture- activity relationship, metabolism and mode of action; other tranquilizers.

Synthesis of chlopromazine.

Unit-III: Drugs acting on autonomous nervous system (ANS).

Adrenergic agents : Chemicel classification,structure-activityrelationship mode of action ;

Adrenergic blocking agents: Synthesist Ephedrine , propranolol, methyl dopa ;

cholinergic agents : Classification, structure - activity relationships-therapeutic actions.

Cholinergic blocking agents: chemical classfication.

Synthesis:Cyclopentolate.

ganglionic blocking agents.

Unit-IV: Drugs curing allergic and urinary infection:

Antihistaminics : chemical classification ; metabolism, structure -activity relationship, mode of action.

.Synthesis : Diphenhydramine, tripelånnamine , chlorcyclizine , promethazine.

Diuretics ( Drugs acting on renal system): Classification, structure-activity relationships and mode of action of organomercurials, phenoxy acetic acids, purines carbonic anhydrase inhibitors, benzothiadiazines , sulphamoyl benzoic acid derivatives, endocrine antagonists.

Synthesis : Meralluride , acetazolamide , furosemide.

## Paper -II: Chemistry of Drugs -II

Unit-I : Drugs acting on infectious diseases:

Anthelmintic agents - Synthesis of diethyl carbamazine, niclosamide.

Antitubercular drugs - synthesis of isoniazide, p-amino salicylic acid and thiacetazone.

Antilepral drugs - Synthesis of dapsone, clofazimine

Sulpha Drugs : Classification, structure - activity relationship, mode of action.

Synthesis: Sulphadiazine, sulphaisoxazole, sulpha dimethoxine.

Unit - II : Antineoplastics: Classification.

Synthesis: Chlorambucil, mercaptapurine

Anti-AIDS and Anti-viral agents (A brief study and medicinal importance)

Antimalarials - Classification Synthesis of Chloroquine

Unit '- III: Plant drugs and Antibiotics

Plant drugs: Chemical composition,characterstics and therapeutic applications of the following plant drugs - Digitalis, strophanthus, ergot, opium, strychnos nux vomica , ipecacuanha , rauwolfia.

Antibiotics: Brief account on the chemistry and mode of action of penicillins, cephalosporins, chloramphenicol, streptomycine and tetracyclines;

Synthesis: chloramphenicol, Penicillin G.

Unit -IV: Steroidal & non steroidal hormones - Brief account on the chemistry, structure - activity relationship and mode of action of estrogens, progestogens, androgens and anabolic agents and adrenal

cortex hormones.
Synthesis: Estrone, estradiol , progesterone, testosterone, cortisone.
Non steroidal hormones: Brief account on the non steroidal hormones and their functions - thyroid,_ para thyroid, pituitary and pancreas hormones .
Synthesis: Thyroxine, adrenaline.

Books Recommended for paper-I &II

1. Essentials of medicinal chemistry , eds., Korolkovas and Burkhaltar, J.H., John wiley & sons .

2. Text book of Organic medicinal and pharmaceutical chemistry by wilson and Gisvold.

3. Synthetic drugs by O. D. Tyagi.

References :

1. Swinyard, E.A., " Remington's phramaceutical sciences ", Ed., Artor Osal, Mack publishing company co., 1980, p.873.

2. "Medicinal Chemistry " Volumes, ed. Burger.
'3. The Organic Chemistry of Drug synthesis by Daniel Lednicer and Lester A. Mitscher

## Paper -III: Drug analysis -I

Unit I : General discussion

Elementary explanation. of IP,BP, USP.
General Idea of the properties of drugs(due to presence of analytically useful groups) for their Characterisation and quantification. The typical drugs included barbiturates, carbamic acid derivatives, anti pyretic analgesics, local anesthetics, organometallic compounds, sulph drugs, antibiotics(Penicillins, cephalosporins, tetracyclines, chlorampenicol, streptomycin, cárdiac glycosides.
General idea of the techniques employed in the determination of drugs.
Sampling, identification tests, limiting tests.

Unit II: Separation techniques

Principles of quantitative separations, solvent extraction. General idea on chromatographic separations of drugs - adsorption, ion exchange, paper, thin layer, molecular sieving, electrophoresis, Gas liquid and high performance liquid chromatography.

Unit III: Quantitative methods of analysis

Gravimetric analysis, volumetric estimations (acid-base, aqueous and non aqueous media; redox; precipatation and.complex formation).

Traditional and electrical properties: potentiometry, coulometry, amperometry and biamperometry titrations; polarography, polarimetry.

Unit IV: Spectroscopy

Colorimetry & spectrophotometry ( UV, Visible and IR), fluorimetry, NMR and Mass spectra.

Paper -IV: Drug analysis –II

Unit I: Good laboratory practice: method validation and quality assurance for testing laboratories.
Hierarchy of analytical methodology(technique, method, procedure, protocal)
validation process: selectivity, linearity, accuracy, precision, sensitivity, range, limit of detection, limit of quantification, ruggedness or robustness.
Quality assuarance: control charts, documenting and archiving, proficiency testing, laboratory acoreditation.
Reliability of analytical data: Errors in chemical analysis, classification of errors, determining the accuracy of methods, improving accuracy of analysis, statistical analysis, rejection of results, presentation of data.
Use of the reagents for the determination of drugs - metol oxidant, fast green FCF, Gibbs reagent, cobalt thiocyanate, MBTH.

Unit II: Microbiology and microscopic examination of plant drugs
General procedure for microbiological assays of antibiotics and disinfectants.
Elementary treatment of methods(morphological, chemical and pharmacological ) suitable for characterization of plant drugs,
Evaluation of plant drugs through microscopical examination.
The plant drugs include Digitalis, strophanthus, ergot, opium, strychnos nux vomica , ipeca caunha , rauwolfia.

Unit III: Applicability of physicochemical methods for the assay of drugs ( any four different methods) based on the presence of analytical useful groups barbiturates, carbamic acid derivatives, anti pyretic analgesics, local anesthetics, organometallic compounds, sulpha drugs, antibiotics (Penicillins, cephalosporins, tetracyclines, chlorampenicol, streptomycin) and cardiac glycosides.

Unit IV : Drug act :

Brief account of drugs and cosmetics act: Definitions of terms - drug quality , adulterated drug, misbranded drugs, imported drugs functions of the drugs, technical advisory board and central drug laboratories; Duties of government analyst and drug inspectors; packing and labelling of drugs; conditions for sale and license conditions for manufacture and license.

Books recommended for Paper III and IV:


l..The Chemical analysis of foods by D. Pearson.
2. Food adulteration by Thankamma Jacob
3. Prevention of food adulteration act, Government of India and Ministry of health.
4. Food analysis by Wood man
5. Instrumental methods of food analysis by A.J. Macleod.
6. Fruit and vegetable analysis by Ranganna.
7. Analysis of Water by J. Rodier.
8. The examination of water and water suppliés by Edwin windle Taylor.
9. Instrumental analysis for water pollution contrle by Mancy.
10. Method of sampling and test for H20 used in industry - ISI


Books Recommended for paper III &IV:


1. Analytical chemistry by Gary D. christian, John wiley & sons

2. Pharmaceutical analysis by T. Higuchi and Brochmann Haussen.

3. Pharmaceutical chemistry ( Volumes I&II) by L.G. Chattan ( for anlytical techniques )

4. Practical Pharmaceutical chemistry by AÉ. Beckett and J.B.Stanlake (for limiting) tests only.

5. Pharmacognacy by C.S. Shaw and J.S. Qudry

6. Microbiology by M.J. Pelezar and R.D. Reld ( for Microbiological assays only)
7. Instrumental methods of chemicial analysis by chatwal and Anand

8. ' Instrumental methods of chemicial analysis by B.K. Sharma

9 Drugs and Cosmetics act.

## III Semister Practicals-Drug Analysis

Assay of typical drugs in dosage forms following procedures incorporated in I.P.,B.P. or U.S.P. :

(a) Acid-base titrations : Ephedrine hyrochlortide ,Adrenaline hydrochloride, barbitone sodium ;
(b) Redox titrations; Aminacrine hydrochloride, benzocaine, ascorbic acid , crystal violet, isoniazid
(c) Complexometric titrations; Calcium gluconate , aluminium hydroxide gel;
(d) Precipitation titrations : Gammaxene ; chlorambutol;
(e) Amodiaquine hydrochloride, vitamin B1 (Gravimetric);
(f) Conductometric titrations : Phenol;
(g) Potentiometric titrations: Phenobarbitone, Ferrous gluconate;
(h) Biamperometric titrations: Sulphadrugs;
(I) Fluorimetric analysis,Quinine, Thiamine ;
(j) Colorimetric analysis: sulphadrugs, folic acid , Acetyl salicylic acid , chloramphenicol, tetracycline:
(k) I.R. Spectrophotometry : Phenacetin
(1) UV spectrophotometry: Cortisone acetate, Ethisterone, Reserpine.

Separation and estimation of drugs:
(a) Nuxvomica seeds - Belladona tincture (Solvent extraction);
(b) Ephedrine hydrochloride (ion-exchange chromatography)
(c) Barbiturates, Carbohydrates(paper and thin layer chromatography)
(d) Protiens and amino acids (electrophoresis and molecular sieving).

Limiting tests for :
(a) Tracer elements(lead, arsenic, iron);
(b) Organic toxicants;
(c) Determinations of moisture and volatile oil in drugs

Microscopical characteristics of plant drugs : Belladona, cinchona, ipecac, Nuxvomica, digitalis, ergot, Rauwolfia, Datura, clove, coriander;

M.Sc. Chemistry(Final)
Specialisation: Chemistry and analysis of Foods, Drugs and water syllabus

IV SEMISTER

Paper -I : Chemistry of Foods - I

Unit-I : Classification, Chemical composition and nutritional value of common food stuffs, properties of foods

Food preservation and processing: Food deterioration, methods of preservation and processing by heat, cold, chill storage, deep freezing, drying, concentration, fermentation and radiation.

Food quality: Sensory evaluation, objective methods, non-nutritional constituents and food safety.

Unit-II : Permitted food additives and their role: Antioxidants, colouring agents, flavours, emulsifiérs, curating agents, non-nutritive sweeteners, flour improvers, leavening agents, stabilizers, thickeners and preservatives.

Unit-III : Pigments and colours (brief study): Chlorophylls, myoglobin and haemoglobin, anthocyanins, flavonoids, tannins, betalains, quinones, xanthones, carotenoids.

Unit-IV : Vitamins: Classification, ftmctions requirements, distribution in foods, loss during processing, effects of deficiency and characteristic properties of vitamins - Bi( Thiamine), B2(Riboflavin), B3 (Pantothenic acid ),Be (pyridoxine),B12 ( Cyanocobalamine), H(Biotin), P( Rutin ) C( ascorbic acid ) A( Retinol) D (Calciferol), E ( Tocopherol) K( naphthoquinone), Folic acid (PGA) and Niacin

Paper - II: Chemistry of Foods - II

Unit I : Enzymes: Classification, specificity, factors effecting the rate of enzyme catalyzed reactions, enzyme inhibitors, enzymic browning, enzymes in food processing - carbohydrates, proteases, lipases, oxido-reductases.

Water: Physical properties, structure of water molecule, bound water.

Unit II : Carbohydrates: Classification, reaótions of simple sugars; Oxidation,

reduction, condensation with phenyl hydrazine, action of alkalies, action of acids, formation of esters, formation of coloured products. Function of sugars in foods - Browning reaction(non-enzymic).

Polysaccharides: Brief study of the chemistry - starch dextrin, glycogen, cellulose, hemicellulose, pectic substances, gums.

sweetness of sugars, relation of structure to sweetness. Carbohydrate metabolism: Interconversion of hexoses in liver, anaerobic metabolism of glucose , krebs citric acid cycle, glyoxalate cycle, pentose phosphate path way.

Unit III : Proteins and amino acids: Amino acids - classification, properties; food proteins - classification, protein structure, properties of proteins, denaturation, protein gels, proteolytic enzymes, chemistry of nucleic acids and their role in protein synthesis.

Unit TV : Lipids: Classification, role of lipids, fatty acids and glycerol derived from oils and fats; Physical properties - polymorphism, reactions of fats, rancidity, reversion, polymerisation, saponification, addition, hydrogenation, phospholipids, lipid metabolism; intermediary metabolism of fatty acids, synthesis of fatty acids.

Books Reconunanded for papers I&II:

1. Food Chemistry by L.W. Aurand and A.E. woods the AVI Publising Inc.
2. Food Chemistry by L.H. Meyer, Affliated East- West press Ltd, New Delhi.
3. Foods- Facts and principles by N. Shakuntala Manay, M. Shdakshara Swamy.
4. Principles of Food Chemistry by John M. deMan.

Refrence Books :

1. Principles of Food Science, Part I,Food Chemistry edited by Owen R. Fennama , Mareal Dekker, Inc., New York.
2. Hand book of Food and Nutrition by M. Swaminathan .

## Paper-III: Food analysis - I

Unit-I : Definitions of standards of quality Assessment of quality using routine and official methods of analysis and interpretation of analytical results:

General methods for the determination of components: carbohydrates,proteins, amino acids, fats,mineral

matter,moisture,crude fibre,synthetic dyes.

preservatives : (sulphur dioxide, benzoic acid, 4 hydroxy benzoic acid, nitrite, sorbic acid).
antioxidants : (Gallates, butylated hydroxy anisole,butylated hydroxy toluene).

Unit-II: Methods for the determination of Water soluble vitamins :(Bi,B2, B3,Bs,B12,Cand folic acid)(Visible spectrophotrometric technique only ).
Methods of determination of fat soluble vitamins : (A,D,E and K) (visible spectrophotmetric technique only).

(Init - III: Inorganic components(minerals): arsenic,Cadmium, copper,lead, mercury, zinc, flourine, sodium, potassium, calcium, phosphorous.

Pesticides :thin layer chromatography and gas liquid chromatography as tools for organophosphorous and organo chlorine pesticides .

Fungal toxins(afflatoxins) ;

Unit - IV: Prevention of food adulteration act: definition of the terms- Food,nutritional food, adulterant, adulteration, misbranded common instances of adulteration in foods, central committee for food standards and central food laboratories and their functions;

public analyst and Food inspectors and their duties. Packing and labelling of foods, conditions for sale and licence, conditions for manufacture and licence ; Restriction on the use of colouring matter, preservatives, antioxidants, non-nutritive sweeteners and insecticides; contaminants in foods.

Paper-IV: Food analysis -II

Unit I : Sugars - Honey gur, cane sugar, jams and jellies.

Fruits and Vegetables: Fruits, canned fruits, pickles, fruit juices, soft drinks, cereals and flours; Wheat flour, maida, bread, rice.

Edible oils and fats: General study of the quality assessment

Unit II : . Non-alcoholic beverages: Analysis of tea, coffee and cocoa; soft drinks.
Alcoholic beverages (Fermentation products) ; Wine, brandy, whisky, beer chider, vinegar.

Herbs and Spices.

Unit III : Meat: composition, nutritional value, assessment of spoilage of raw meat and cured meat, Sausage meat, meat extract.

' Fish: Raw fish, canned fish, fish caves - nutritional value and spoilage assessment.

Dairy products: Quality assessment of milk, butter, ghee, milk powder and ice-cream.

Unit - IV : Water analysis: sampling, determination of the origin of infiltration's, organoleptic characterization, preliminary examination, physicochemical determination.

Chemical and microbiological constituents of water; acidity and alkalinity, anions( phosphate,chloride, nitrite, nitrate,sulphate, silica), Cations(calcium,magnesium) , chemical pollution indicators (free and saline ammonia albuminoid ammonia, Organic nitrogen, oxygen consumed by permanganate, chemical and biological oxygen demand), toxic elements(chromium, fluorine, arsenic and lead), undesirable elements(aluminium, copper, iron, manganese and zine), bacteriological analysis (detection and count of bacteria indicating faecal pollution).