



Federal Urdu University

of Arts, Science and Technology

Syllabus

Organic Chemistry

(BS & MSc)

Department of Chemistry

2012

BS: 2nd Year

Title of the Course:
Credit Hours: (3+1)

Organic Chemistry

Code: CHEM-161
Marks: 100

1- BASIC CONCEPTS IN CHEMICAL BONDING (5 CREDITS)

Localized and delocalized bonding; concept of hybridization leading to bond angles, bond energies and geometry of simple organic molecules; dipole moment; inductive effect; resonance, resonance energy, rules of resonance, resonance effect, steric inhibition of resonance; hyperconjugation; Tautomerism; hydrogen bonding.

2- HYDROCARBONS (5 CREDITS)

Open Chain: Nomenclature, preparation, properties and reactions of alkanes, alkenes and alkynes.

Closed Chain: Nomenclature, synthesis, reactions and relative stability of small and medium sized cycloalkanes.

Aromatic Compounds: Structure of benzene, aromaticity, electrophilic substitution including orientation and reactivity, addition and oxidation reactions, preparation and reactivity of naphthalene.

3- ISOMERISM (5 CREDITS)

Geometrical isomerism: Determination of configuration of geometrical isomers, Z, E convention and cis- and trans- isomerism in compounds containing one double bond;

Optical isomerism: Optical activity, chirality and specific rotation, Enantiomers, racemisation and resolution of racemic mixtures, R, S notation, diastereoisomers.

Conformational isomerism: A brief introduction to conformation of ethane, n-butane and cyclohexane.

4- FUNCTIONAL GROUP CHEMISTRY (12 CREDITS)

A brief introduction to the chemistry of alkyl halides, hydroxyls, ethers and amines (Nomenclature, preparation, properties and reactions).

5- CARBONYL GROUP CHEMISTRY (10 CREDITS)

A brief introduction to the chemistry of aldehydes, ketones, carboxylic acids and their derivatives (Nomenclature, preparation, properties and reactions)

6- AN INTRODUCTION TO HETEROCYCLIC COMPOUNDS (3 CREDITS)

Nomenclature of simple heterocyclic structures containing oxygen, nitrogen and sulfur in five and six membered rings (saturated and aromatic). The chemistry of furan, pyrrole, pyridine and thiophene (one simple synthesis, physical properties, and electrophilic substitution reactions). Aromatic character of pyrrole and pyridine.

7- AN INTRODUCTION TO SPECTROSCOPY (3 CREDITS)

Introduction of spectroscopic methods: Nuclear Magnetic Resonance (NMR), Infrared (IR), Ultraviolet (UV) & Mass spectroscopy (MS), structure elucidation of some simple organic compounds by these spectroscopic techniques (ethanol, ethanal, Phenol).

8- AN INTRODUCTION TO BIOMOLECULES (2 CREDITS)

A brief outline to the chemical nature of carbohydrates, proteins, lipids and nucleic acids (Introduction, classification and their importance in living systems).

Practical

Fifteen experiments shall be conducted based on the following:

a. Qualitative Organic Analysis

Systematic identification of organic compounds (10 compounds)

b. Quantitative Analysis of Functional Group

i) $-\text{COOH}$ ii) $-\text{NH}_2$

c. Preparation of Organic Compounds

One step synthesis of simple organic compounds like iodoform, aspirin, acetanilide.

Recommended Literature

Theory

1. McMurry.J, "Organic Chemistry" Thomson Asia Ltd; Singapore, Fifth Edition (2000).
2. Robert C. Atkins, Francis A. Carey, "Organic Chemistry" Third edition (2002).
3. Carrey.F.A, "Organic Chemistry" The McGraw-Hill Companies, Inc; Fourth Edition (2000).
4. Finar.I.L, "Fundamental Principles of Organic Chemistry" Longman, Third Edition, Vol.1 (1959).
5. March.J, "Advanced Organic Chemistry Reactions, Mechanisms and Structure" John Wiley & Sons (latest edition available).
6. Bansal.R.K, "A Text book of Organic Chemistry" Wiley Eastern Ltd; Second Edition (1990).
7. Morrison.R.T, Boyd.R.N; "Organic Chemistry" Prentice-Hall, Inc; Sixth Edition (1992).
8. Pine.S.H, Hendrickson.J.B Hammond.G.S, "Organic Chemistry" McGraw-Hill, Inc; Fourth Sons.Inc; Fourth Edition (1992).

Practicals

1. Furniss.B.S, Hannaford.A.J, Rogers.V, Smith.P.W.G, Tatchell.A.R, "Vogel's Text book of Practical Organic Chemistry Including Qualitative Organic Analysis" Longman Group Ltd; Fourth Edition (1986).
2. I.Gosney.J.T.S, Rowley.A.G, "Practical Organic Chemistry" Chapman and Hall (1990).
3. Mann.F.G, Saunders.B.C, "Practical Organic Chemistry" Lowe and Brydone (Printers) Ltd; Thetford, Norfolk (1975).
4. Shriner.R.L, Fuson.R.C, Curtin.D.Y and Morrill.T.C, "The Systematic Identification of Organic Compounds (a laboratory manual)" John Wiley & Sons, Inc; Sixth Edition (1980).
5. Vogel, A., I., "Practical Organic Chemistry", Longman Green & Co, (1995).

BS 3rd Year, Semester-V
M.Sc. (Previous), Semester-I

Title of the Course:
Credit Hours: (3+1)

Organic Chemistry

Code: CHEM-261
Marks: 100

1- ACIDS AND BASES (8 CREDITS)

Concepts of acids and bases; scale of acidity and basicity; pK_a values; predicting acid/base reactions from pK_a values; the effect of structure on the strengths of acids and bases, field effects, resonance effects, steric effects, hydrogen bonding effects and hybridization effects; the effect of the medium on the strengths of acids and bases; the Hammett and Taft's equations-applications and limitations.

2- STEREOCHEMISTRY (10 CREDITS)

Introduction; classification of isomerism; optical isomerism: optical activity, chirality and optical activity, symmetry elements and optical inactivity, relative and absolute configuration, R,S notation, method of determining configuration, racemic mixtures and their resolution, asymmetric synthesis, optical activity in biphenyls, allenes and spiro compounds, stereospecific and stereoselective reactions; geometrical isomerism: determination of configuration of geometrical isomers, Z,E convention and *cis trans* isomerism in cyclic systems; conformational isomerism: conformational analysis of mono-substituted cyclohexanes, di-substituted cyclohexanes and decalin systems.

3- INTRODUCTORY ORGANIC SPECTROSCOPY (7 CREDITS)

Introduction to IR, UV, $^1\text{H-NMR}$ and Mass spectrometric methods, and their usage for structure elucidation of some simple organic compounds.

4- ALIPHATIC SUBSTITUTION REACTIONS (10 CREDITS)

Aliphatic Nucleophilic Substitution Reactions: Mechanisms—study of SN_2 , SN_1 , SN_i , SN_2' , SN_1' , SN_i' mechanisms; neighbouring group participation—intramolecular displacement by neighbouring oxygen, nitrogen, sulphur and halogen; structure and reactivity—effects of the substrate structure, entering group, leaving group and reaction medium on the mechanisms and rates of substitution reactions.

Aliphatic Electrophilic Substitution Reactions: Mechanisms—study of SE_1 , SE_2 (front), SE_2 (back) and SE_i mechanisms; structure and reactivity—effects of substrate, leaving group and medium on the rates of these reactions.

5- ELIMINATION REACTIONS (10 CREDITS)

Eliminations Proceeding by Polar Mechanisms: Study of E_1 , $\text{E}_{1\text{cB}}$ and E_2 mechanisms; orientation: Saytzeff and Hofmann rules; structure and reactivity—the effects of substrate structure, attacking base, leaving group and the reaction medium on the rates and mechanisms of elimination reactions; competition between elimination and substitution reactions.

Eliminations Proceeding by Non-polar Mechanisms: Pyrolytic eliminations—study of E_i and free-radical mechanisms; orientation in pyrolytic eliminations.

Practical

Fifteen experiments shall be conducted based on the following:

a. Qualitative Organic Analysis

Systematic identification of binary mixture organic compounds (10 mixtures)

b. Quantitative Analysis of Functional Group

For example i) –OH ii) –CHO iii) –CONH₂ (5 estimations)

Recommended Literature

(Latest available editions of the following books)

1. Eliel, E. L., Wilen, S. H. and Doyle, M. P., "Basic Organic Stereochemistry", Wiley Interscience, New York.
2. Loudon, G. M., "Organic Chemistry", Oxford University Press, New York.
3. March, J., "Advanced Organic Chemistry", John Wiley & Sons, New York.
4. Sykes, P., "A Guide Book to Mechanism in Organic Chemistry", Longman, London.
5. Norman, R. O.C. and Coxon, J. M., "Principles of Organic Synthesis", Nelson Thornes, Cheltenham.
6. Kalsi, P.S. "Spectroscopy of Organic Compounds", Wiley Eastern Ltd., New Delhi.
7. Pavia, D. L., Lampman, G. M. and Kriz, G. S., "Introduction to Spectroscopy: A Guide for Students of Organic Chemistry", Saunders Golden Sunburst Series, London.
8. Morrison, R. T. and Boyd, R. N., "Organic Chemistry", Prentice-Hall of India, New Delhi.

Supplementary Literature

(Latest available editions of the following books)

1. McMurry, J., "Organic Chemistry", Brooks/Cole Publishing Company, California.
2. Carey, F. A., "Organic Chemistry", McGraw-Hill, New York.
3. Solomons, T. W. G. and Fryhle, C. B., "Organic Chemistry", John Wiley & Sons, New York.

BS 3rd Year Semester-VI
M.Sc. (Previous), Semester-II

Title of the Course:
Credit Hours: (3+1)

Organic Chemistry

Code: CHEM-361
Marks: 100

1- ADDITION REACTIONS (10 CREDITS)

Electrophilic and Nucleophilic Addition to C=C: Their mechanisms, orientation and stereochemistry; electrophilic addition of halogens and hydrogen halides to C=C; electrophilic addition to conjugated dienes; nucleophilic addition to C=C and C=C-C=O linkage.

Nucleophilic Addition to C=O: Structure and reactivity of carbonyl group; simple addition reactions i.e. addition of water, alcohol, hydrogen cyanide and bisulphite; addition/elimination reactions: addition of derivatives of ammonia; stereoselectivity in carbonyl addition reactions.

2- ORGANOMETALLIC COMPOUNDS (7 CREDITS)

Principles; organomagnesium, organosodium, organolithium, organocopper, organocadmium, organomercury and organozinc compounds: their structure and reactivity, methods of preparation and synthetic applications.

3- CHEMISTRY OF ENOLATE IONS AND ENOLS (8 CREDITS)

Acidity of carbonyl compounds; enolization of carbonyl compounds; α -halogenation of carbonyl compounds; aldol-addition and aldol-condensation; condensation reactions involving ester enolate ions; alkylation of ester enolate ions.

4- AROMATIC SUBSTITUTION REACTIONS (10 CREDITS)

Electrophilic Substitution Reactions: Mechanisms of substitution; orientation and reactivity; electrophilic substitution reactions i.e. nitration, halogenation, sulphonation, Friedel-Craft's reaction, diazocoupling, formylation and carboxylation.

Nucleophilic Substitution Reactions: Mechanisms - study of S_NAr, S_N1 and benzyne mechanisms; structure and reactivity - the effects of substrate structure, leaving group and the attacking nucleophile on the rates of substitution reactions.

5- AROMATIC HETEROCYCLES (10 CREDITS)

Introduction; nomenclature; structure and aromaticity; basicity and acidity of the nitrogen heterocycles; chemistry of furan, pyrrole and thiophene; synthesis of indoles and isoindoles; chemistry of pyridine, quinoline and isoquinoline; occurrence of heterocyclic compounds.

Practical

Fifteen experiments shall be conducted based on the following:

a. Preparation of Organic Compounds

Two step synthesis of organic compounds (5 compounds)

b. Confirmation of purity

Confirmation of purification of synthesized compounds by chromatographic techniques, e.g. paper chromatography, thin layer chromatography etc.

Recommended Literature

(Latest available editions of the following books)

1. Sykes, P., "A Guide Book to Mechanism in Organic Chemistry", Longman, London.
2. I. L Finar "Organic Chemistry" Vol. I and II
3. Norman, R. O.C. and Coxon, J. M., "Principles of Organic Synthesis", Nelson Thornes, Cheltenham.
4. March, J., "Advanced Organic Chemistry", John Wiley & Sons, New York.
5. Loudon, G. M., "Organic Chemistry", Oxford University Press, New York.
6. Carey, F. A., "Organic Chemistry", McGraw-Hill, New York.
7. Morrison, R. T. and Boyd, R. N., "Organic Chemistry", Prentice-Hall of India, New Delhi.
8. Clayden, J., Greeves, N., Warren, S. and Wothers, P., "Organic Chemistry", Oxford University Press, New York.

Supplementary Literature

(Latest available editions of the following books)

1. Solomons, T. W. G. and Fryhle, C. B., "Organic Chemistry", John Wiley & Sons, New York.
2. Pine, S. H., "Organic Chemistry", National Book Foundation, Islamabad.
3. Bruckner, R., "Advanced Organic Chemistry-Reaction Mechanisms", Harcourt Science & Technology Company, New York.
4. Carroll, F. A., "Perspectives on Structure and Mechanism in Organic Chemistry", Brooks/Cole Publishing Company, New York.
5. Ege, S., "Organic Chemistry", A.I.T.B.S. Publishers & Distributors, Delhi.
6. Parkins, A. W. and Poller, R. C., "An Introduction to Organometallic Chemistry", Macmillan, London.

BS 4th Year Semester-VII M.Sc. (Final), Semester-I

Title of the Course:
Credit Hours: (4+0)

Reaction Mechanism-I

Code: CHEM-462
Marks: 100

1. TYPES OF REACTION (6 CREDITS)

Substitution
Addition
Elimination
Rearrangement
Free Radical reaction
Oxidation and Reduction

2. REACTION INTERMEDIATES (6 CREDITS)

Carbonium ion, Carbanion, Carbene, and Nitrenes.

3. NUCLEOPHILIC SUBSTITUTION AT SATURATED CARBON ATOMS (12 CREDITS)

SN1 and SN2 reaction, Factors effecting rate of SN1 and SN2 reactions, Effect of Solvent, Effect of structure, Effect of entering and leaving groups, SNi mechanism, Retention of Configuration, Neighbouring group participation [retention in configuration], Ritter reaction, Williamson ether synthesis, Wurtz reaction, Wurtz fittig reaction.

4. ELECTROPHILIC AND NUCLEOPHILIC SUBSTITUTION IN AROMATIC SYSTEM (12 CREDITS)

Halogenation, Sulphonation, Friedel Craft's alkylation, Friedel Craft's acylation reaction. Diazocoupling reaction, Electrophilic attack on C₆H₅Y, Gattermann - Koch reaction, Hoesch reaction, Chloromethylation, Kolb reaction, Reimer-Tiemann reaction.

5. NUCLEOPHILIC AROMATIC SUBSTITUTION BY ADDITION ELIMINATION (12 CREDITS)

The S_NAr mechanism, Nucleophilic Aromatic Substitution through an elimination-addition mechanism, Benzyne, Sandmeyer reaction, Fries rearrangement, Vilsmeier reaction, Ullmann reaction.

6. ELIMINATION REACTION (12 CREDITS)

Elimination reaction, E1 mechanism and E2 mechanism. Stereochemistry of E2 elimination, Saytzeff's rule, bredt's rule, b elimination, Hofmann elimination and Holmann rule, Saytzeff v/s Holmann. Effects of activating groups. Trans elimination, Dehalogenation, Decarboxylation elimination, fragmentation reaction, formation of alkynes and arynes, oxidative elimination reactions.

Recommended Literature

1. Mechanism in Organic Chemistry, . by Peter Syke 6th Ed.
2. Organic Chemistry by Jerry March. IV and V th Ed.
3. Organic Chemistry by R. T. Morrison and R. W. Boyd, VI Edition, (1992).
4. Organic Chemistry by T. W. Garhom Solomons, 6th Ed. John Wiley and Sons.

BS 4th Year Semester-VII M.Sc. (Final), Semester-I

Title of the Course: Spectroscopy
Credit Hours: (4+0)

Code: CHEM-463
Marks: 100

1. INTRODUCTION OF SPECTROSCOPY (5 CREDITS)

Electromagnetic spectrum, Molecular energy levels, Electromagnetic Radiation, radiation and molecules, Molecular transition and spectral regions.

2. INFRA RED SPECTROSCOPY (10 CREDITS)

Portion of IR in EMR spectrum, Infrared Absorption Process, Uses of IR Spectrum, The modes of stretching and bending vibrations, Bond properties and absorption trends. The infrared spectrophotometer, Sample Preparation for IR Spectroscopy. Correlation charts and tables, approach for the analysis of IR spectrum. Characteristic group frequencies e.g. Hydrocarbons, Alcohols and Phenols, carbonyl compounds ethers and amines. Interpretation of IR spectrum.

3. NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY (15 credits)

Nuclear magnetic moments, Absorption of energy. The mechanism of absorption energy (resonance), The chemical shifts and shielding, NMR spectrometer, Integral and integration, Chemical environment and chemical shifts, Magnetic anisotropy, Local diamagnetic shielding, Spin-spin splitting (n+1) Rule, The origin of spin-spin splitting, The coupling constant and interpretation of ¹H-NMR spectrum.

4. ¹³C NMR SPECTROSCOPY (5 credits)

The carbon-13 Nucleus, carbon-13 chemical shifts, Correlation charts and calculation of ¹³C Chemical shifts, Proton coupled ¹³C-spin-spin splitting of carbon-13 signals, protons-decoupled ¹³C spectra.

5. MASS SPECTROMETRY (10 credits)

Classical Methods to determine the molecular weight and molecular formula. Index of hydrogen deficiency and C-13 Rule with practice examples. Basic concepts about mass spectrum (Molecular ion peak, Base peak, Isotopic peaks, Metastable peak, Relative abundance, etc.) Determination of molecular formula from isotopic peaks and Molecular ion peaks. The Mass Spectrometer and its applications. Fragmentation Pattern of different functional groups. e.g; Alkane, Cycloalkane, Alkene, Cycloalkene, Alkyne, Aromatic Hydrocarbons, Alcohols, phenols, Aldehyde, Ketone, Ether, Carboxylic Acid, Esters, Amines, Amide etc. Introduction to some modern techniques used for the determination of molecular mass of compounds, e.g; EI, CI, FD, FI, FAB, MALDI, ESI. Types of analyzers in mass spectrometer, Single and double focusing analyzers, Quadrupole analyzer, Time of flight, Cyclotron analyzer, Tandem mass spectrometry analyzer (Ms/Ms).

6. ULTRAVIOLET SPECTROSCOPY (10 credits)

The nature of electron excitations, the origin of UV band structure, principles of absorption spectroscopy, Instrumentation, Presentation of spectra, solvents, chromophore, the effect of conjugation, The Woodward Rules for diene and enones and Interpretation of UV spectrum.

7. COMBINED SPECTRAL PROBLEMS (5 credits)

Structure elucidation of compound by spectroscopic method using IR, NMR, UV and MS spectroscopy.

Recommended Literature

1. Introduction to Spectroscopy, by Donald L. Pavia, Saunders Golden Sunburst Series, Harcourt Brace College publisher 2nd Ed., (1986).
2. Spectrometric identification of Organic Compound R. M. Silverstein, G. Clayton, T. C. Mortin, V Ed., John Wiley and sons, inc. (1991).
3. Spectroscopy of Organic Compound by P. S. Kalsi, (1995), New age international, New Delhi.
4. Modern NMR Techniques for Chemistry Research, Andrew E. Derame, vol. 6, (1989), Pergamon press.

**BS 4th Year Semester-VII
M.Sc. (Final), Semester-I**

Title of the Course:
Credit Hours: (4+0)

Nitrogenous Compounds

Code: CHEM-464
Marks: 100

CHEMISTRY OF ORGANIC NITROGEN COMPOUNDS

(EXCLUDING ALKALOIDS)

1- Basic concepts in nitrogenous compounds (6 credits)

Nomenclature of nitrogenous compounds according to I. U. P. A. C. and accepted rules.
Oxidation state of nitrogen, Oxidation level of nitrogen

2- Acid base theory in nitrogenous compounds (8 credits)

Acidity and basicity of nitrogen containing compounds with example. Factors which control the acid and basic strength. Aromatic base, Heterocyclic base

3- Derivative of Ammonia (10 credits)

Derivatives of Ammonia, Reaction of amines with Nitrous acid
Diazo coupling reactions, Diazoamine amine azo rearrangement

4- Rearrangements in nitrogenous compounds (4 credits)

Rearrangement of N- substituted Arenamine
Wallach rearrangement

5- Oxidation (4 credits)

Oxidation of Amines: a) Aliphatic amines, b) Aromatic amines

6- Reactions of nitrogenous compounds (14 credits)

Nitramines and Nitramides

Cyanates and Isocyanide

Aliphatic and aromatic nitrogen compounds

Azomethane, Arnot reaction, pyrolizine formation

Pseudomauvin and aniline black

a) Methods for applying dyes to fibers, b) commercial uses of light absorbing compounds
c) colour photography

7- Bio-molecules (8 credits)

Amino acids, Proteins, peptide and enzymes

8- Polymers (6 credits)

Polymers containing nitrogen, Nylon

Recommended Literature

1. A guide book of organic reaction mechanism, by Peter Sykes
2. Basic principles of Organic Chemistry, by J. D. Robert and M. C. Cassero
3. The Chemical Basis of Life, by G.H Schmid, Little Brown Company , Boston
4. Advance Organic Chemistry III, Ed., Part B Reaction and Synthesis by Francis A. Carey and R. J. Sundberg, Plenum press, New York, (1990).
5. Organic Chemistry , First Ed., J.C. Claden, N. Greeves, S. Warren and P. Wothers, Oxford Univ. Press Inc., (2001).

**BS 4th Year Semester-VII
M.Sc. (Final), Semester-I**

Title of the Course:
Credit Hours: (0+4)

Advanced Practical

Code: CHEM-461
Marks: 100

1- Qualitative Organic Analysis (30 credits)

Analysis of organic mixture containing three organic compounds (at least 10 different mixtures)

2- Synthesis of organic compounds (30 credits)

Three step synthesis, purification through chromatographic techniques (at least 5 different compounds)

BS 4th Year Semester-VIII M.Sc. (Final), Semester-II

Title of the Course: Organic Synthesis Code: CHEM-562
Credit Hours: (4+0) Marks: 100

1. BASIC CONCEPTS IN RETROSYNTHESIS (6 credits)

Importance of organic synthesis and comparison with retrosynthesis, Introduction to synthones, Synthetic Equivalent, Target molecule, Arrow notation, and disconnection, FGI. Some common examples of retrosynthesis.

2. DESIGNING OF SYSTHESIS (6 credits)

Range of possibilities of disconnection. Linear and convergent synthesis, symmetry, yield and conversion, High yield and Recognizable starting material.

3. FGI AND PROTECTING GROUPS (6 credits)

Functional group Inter-conversions (FGIs) of carboxylic acid, aldehydes and ketones, alcohols and their derivatives, Oxidation and Reduction, Removal of functional group. Protecting groups of alcohols, aldehyde, ketones amino acids an sugars.

4. ONE - GROUP DISCONNECTIONS (6 credits)

Alcohols and Carbonyl compounds.

5. TWO- GROUPS DISCONNECTIONS (12 credits)

1,3--Difunctionalized compounds and a,b-unsaturated carbonyl compounds, 1,5-, 1,2- and 1,4-difunctionalised compounds.

6. RING SYNTHESIS (12 credits)

Cyclization reactions, synthesis of three-, four-, five-, and six-membered compounds. Retrosynthesis in Aromatic system.

7. SELECTIVITY (12 credits)

Chemoselectivity, Chemoselective reactions, Regioselectivity, Thermodynamically and Kinetically control products. Regioselective preparation of alkenes, Regioselective electrophilic addition to alkenes, Regioselectivity of ring opening of epoxides, Regioselective alkylation of ketone, Stereoselectivity-Stereospecific and stereoselective reactions.

Recommended Literature

- 1) Synthetic Organic Chemistry, Ramlesh Bansal, Campus Books, (200).
- 2) Organic Synthesis, the Disconnection Approach, Stuart Warren, John Wiley and Sons, Torontor, (1986).
- 3) Synthetic Approach in Organic Chemistry by Raj R. Bansal, (1996), Narosa publishing House, New Delhi (1996).
- 4) Retrosynthehsis Approach to Organic Synthesis, S. S. Nizami, (2003), Higher Education Commission, Islamabad

BS 4th Year Semester-VIII

M.Sc. (Final), Semester-II

Title of the Course: Reaction Mechanism II

Code: CHEM-563

Credit Hours: (4+0)

Marks: 100

1. NUCLEOPHILIC AND ELECTROPHILIC ADDITION TO C=C BOND (12 credits)

Addition of halogens, Addition of Br-Br to cis and trans 2-butene, Effect of substitution on rate of addition, Orientation of addition of halogens, Hydroxylation, Ozonolysis, Addition to conjugate dienes, Electrophilic addition [1,2 and 1,4-addition], Diels Alder reaction, Nucleophilic addition [Cyanoethylation, Michael reaction, Addition to C=C-C=O, Nucleophilic addition at saturated carbon atom., Cleavage of ether, Gabriel synthesis, reaction of Grignard's reagent, Alkylation by active methylene groups, Reaction of Acetylene in the presence of strong base, Malonic ester synthesis, Acetylene in the presence of strong base, Methylation with Diazomethane, Malonic ester synthesis, Acetoacetic ester synthesis.

2. NUCLEOPHILIC ADDITION TO C=O BOND (12 credits)

Hydration, Acetal and hemiacetal, Thioacetal, Addition of HCN and Bisulphite and other anions, Hydride ions, Complex metal hydride ions, Meerwein Ponderof reaction, Cannizzaro reaction, Cross Cannizzaro reaction, Reaction of C=O with ammonia and its derivatives, Reaction of C=O with Grignard reagents, Acyloin condensation, Aldol Condensation, Reaction of C=O with acetylide anion, Cross Aldol Condensation, Nitroalkanes, Perkin reaction, Knoevenagel and Stobbe reactions, Claisen ester condensation, Dieckmann condensation, Benzoin condensation, Benzilic acid rearrangement, Wittig reaction, Acid catalysed reactions, [Esterification and hydrolysis of esters], Addition to nitriles, Darzen reaction, Alkaline hydrolysis of ester, Strecker synthesis of aminonitrile.

3. MOLECULAR REARRANGMENTS (12 credits)

Rearrangement of electron deficient system, Hoffmann, Curtius reaction. Beckmann rearrangement, Baeyer Williger oxidation, Decker oxidation, Schmidt rearrangement, rearrangement of peroxide, pinacol rearrangement, Wanger Meerwein rearrangement, Wolff rearrangement of electron rich system. Stevens, Wittig, Sommelet, Favorski rearrangement, benzilic, allylic, neopentyl and acyloin rearrangements.

4. RADICALS AND THEIR REACTIONS (12 credits)

Stable free radicals, Generation of transients stable free radicals, generation of transient radicals, radical ions, radical coupling reactions, Kolbe electrolysis, substitution at saturated carbon, Hunsdiecker reaction, autooxidation, nitration, addition. Aromatic substitution, vinyl polymerization, halogenation. Use of N-bromosuccinimide, arylation, configuration of radicals, diradicals.

5. OXIDATION AND REDUCTION (6 credits)

Study of various oxidation and reduction procedures and their mechanisms. Methods of oxidizing and reducing common functional groups.

6. OPTICAL ISOMERISM (06 credits)

Enantiomers, Diastereomers, Resolution, Optical Activity.

Recommended Literature

1. Basic Principles of Organic Chemistry, by J. D. Robert, W. A. Benjamin, Inc. New York.
2. Organic Chemistry by Jerry Mardi. IV and V th Ed.
3. Organic Chemistry by R. T. Morrison and R. W. Boyd, VI Edition, (1992).
4. Organic Chemistry by T. W. Garhom Solomons, 6th Ed. John Wiley and Sons.

BS 4th Year Semester-VIII M.Sc. (Final), Semester-II

Title of the Course: Pharmaceutical Chemistry Code: CHEM-564

Credit Hours: (4+0) Marks: 100

1. Physicochemical Properties in Relation to Biological Action (2 credits)

Complex events between drug administration and drug action. Solubility and partition coefficient. Drug-Receptor interactions.

2. Factors influencing dosage formulations (2 credits)

Disintegration and dissolution. Absorption of drugs, its prerequisites, effective blood level, Placebo effects, MIC value etc. Drug-drug interactions

3. Drug Metabolism (3 credits)

Factors influencing metabolism of drugs. Site of metabolism, metabolic changes in GI tract. Types of metabolic reaction. Reactions based on functional groups.

4. Introduction to Structure-Activity Relationship (SAR) (3 credits)

Chemical structure in relation to biological activity of molecules. Stereochemical factors in SAR. effect of various functional groups on the biological activity of molecules. Prodrugs, Isoster and Pharmacophore groups.

5. Synthesis, physical and Chemical properties, mode of action, SAR studies and Toxicity of:

- i. Sulfa Drug, sulfa drugs in current therapy (Human and veterinary use) (4 credits)
- ii. Diagnostics Agents. (3 credits)
- iii. Antibiotics, penicillins, cephalosporins, tetracycline, chloramphenicol, quinolones. (18 credits)
- iv. Anti-viral agents and anti-neoplastic agents. (7 credits)
- v. Histamine and anti histamines. H1 and H2-receptor antagonists. Development of H3-receptors. Proton pump inhibitors. (3 credits)
 - vi. Anti malarials (5 credits)
 - vii. Analgesics.(Peripheral as well as centrally acting) (4 credits)
 - viii. Local and General Anesthetics (6 credits)

Recommended Literature

1. Medicinal Chemistry, by Alfred Berger, 4th and 5th editions, John Wiley Interscience N.Y.
2. A text book of Organic Medicinal and Pharmaceutical Chemistry, by Wilson Gisvold and Doerge. 9th Edition, Lippincott.
3. Essential of Medicinal Chemistry, by Korolkovas and Burkhalter, Wiley Interscience N.Y.
4. The chemistry of Organic Medicinal Products, by G. L. Jenkins et al., Wiley Interscience N. Y.
5. Isolation and Identification of Drugs, by E. C. G. Clarks Vol. I and II. the Pharmaceutical Press, London.
6. An introduction to Medicinal Chemistry, by Graham L. Petrick 3rd edition (2006), Oxford University Press.
7. Basic and Clinical Pharmacology, by Bartram G. Katzung, 9th edition, (2004), Mc Graw Hill, US.
8. A Text Book of Organic Medicinal and Pharmaceutical Chemistry, by Wilson Gisvold and Doerge. 9th Edition, Lippincott.

BS 4th Year Semester-VIII
M.Sc. (Final), Semester-II

Title of the Course: Research Project / Advanced Practical

Code: CHEM-561

Credit Hours: (0+4)

Marks: 100

1- Natural Product Chemistry (30 credits)

Isolation of organic compounds from different natural products, e.g.

- a) Lactone from milk
- b) Caesine from milk
- c) Piperine from black pepper
- d) Caffeine from tea leaves
- e) Cystine from hairs
- f) Literature Survey of given plant

2- Quantitative Analysis of Functional Group (30 credits)

Estimation of different functional group

- 3+1 کورسز میں نظری کلاسز 45 اور عملی کلاسز 15 مختص کی گئی ہیں۔
- 4+0 کورسز میں نظری کلاسز 60 مختص کی گئی ہیں۔
- 0+4 کورسز میں عملی کلاسز 60 مختص کی گئی ہیں۔
- نظری اور عملی کورسز دیئے گئے کریڈٹ آوز میں مکمل کی جائیں۔ یہ بھی ضروری ہے کہ مختص کئے گئے کریڈٹ آوز بھی مکمل کئے جائیں۔