B.Sc. (Hons.) Syllabus of Organic Chemistry

# Semester I

## COURSE: CCCH2A( 5+1):Group A (Theory, Organic Chemistry)

Credit (2+1)

### Basics of Organic Chemistry: 12 Lectures

*Organic Compounds:* Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties.

*Electronic Displacements:* Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.

*Reaction Mechanism:* Homolytic and Heterolytic fission with suitable examples; Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.

Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

### Stereochemistry: 18 Lectures

Concept of constitution, configuration and conformation of Organic molecules, Geometrical isomerism, enantiomerism and diastereomerism, chirality and optical activity, elements of symmetry, asymmetry and dissymmetry, R/S, E/Z, D/L, syn/anti, cis/trans, meso/dl, threo/erythro –nomenclature system, Fischer, Sawhorse, Flying Wedg, Newman formulae, Racemization and resolution, resolution of racemic acids, bases and alcohols; optical purity/enetiomeric excess. Axial chirality of allenes, biphenyls, conformation of cyclohexane systems, Topicity of ligands and faces (elementary idea); homotopic, enantiotopic and diastereotopic ligands and faces, prochirality, pro-R/Pro-S and re/si descriptors, Conformational isomerism – eclipsed, staggered gauche and anti; concept of dihedral and torsion angle, energy diagram during variation of torsion angle.

## Learning Objective

1. To make a connection between shape and electronic structure of molecule

2. To predict the basic structural effects like inductive, steric and resonance effect

1. To predict the reactivity of the molecule with other reagents

4. To represent the movement of electrons in bond breaking and bond making processes by curely arrows

5. To classify the reactions as the combination of some fundamental processes like substitution, addition and elimination steps.

1. To predict a relatively complex mechanism of some unknown reaction
2. To gain knowledge on the basic 3-D structure of a molecule
3. To relate the 3-D structure with its optical properties.
4. To gain knowledge on the stereoisomerism.

## Learning outcome

At the end of this course the students can correlate the electronic structure of a molecule to its specific geometry. He can also predict the reactivity on the basis of it structural properties. He also gain knowledge on how to draw reaction mechanism and divide a complete reaction on several elementary steps. He do also have an idea on the 3-D structure and the related properties of a molecule.

## Recommended Texts

1. Clayden J., Greeves N., Warren S. & Wothers P. “Organic Chemistry”
2. Sykes, P. “Mechanism in Organic Chemistry” (6th ed.)

# Semester II

## COURSE CCCH4A: Organic Chemistry Group A (Theory, Credits:04)

### Chemistry of Aliphatic Hydrocarbons: Lecture 20

A. Carbon-Carbon sigma bonds:Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

B. Carbon-Carbon pi bonds: Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

*Reactions of alkenes:* Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

*Reactions of alkynes:* Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

### Alkanes, Cycloalkanes and Conformational Analysis: 16 Lectures

Nomenclature, types of strain, Bayer strain theory, measurement of strain and classification of ring sizes, consequences of strain in small, normal, medium and large ring, conformation behaviours of normal rings, substituted cyclohexanes, effect of substitution on ring conformation of cyclohexane, conformation of cyclohexene, effect of strain on reactivity, ring synthesis - principles controlling ring closure reactions, rules for ring closure (Baldwin's rule), ring expansion and contraction processes, polycyclic system - Bredt's rule, Conformational analysis of n-butane, dihaloethanes, glycols.

### Aromatic Hydrocarbons: 12 Lectures

*Aromaticity:* Hückel’s rule, aromatic character of arenes, cyclic carbocations/carbanions and

heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft’s alkylation/acylation with their mechanism. Directing effects of the groups.

### Chemistry of Halogenated Hydrocarbons: 12 Lecture

*Alkyl halides:* Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.

*Aryl halides:* Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

## COURSE: CCCH4B (Practical, Credits: -02) (60 Lectures)

1. Purification of organic compounds by crystallization using the following solvents:

* Water
* Alcohol
* Alcohol-Water

2. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)

3. Qualitative analysis of solid organic compounds in respect of the following: Detection of elements, determination of M.P., detection of functional group and preparation of a derivative (with M.P):

4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.

## Learning Objective

- To gain knowledge on the structure and properties of special class of organic compounds, viz., aliphatic hydrocarbons, aromatic hydrocarbons and alkyl halides.

- To gain knowledge on the reactivities and reaction mechanisms related to the hydrocarbons and halides.

* To identify the reaction intermediates in the free radical mechanism.
* Empirical rules for regioselectivity associated with elimination process.

- Practical knowledge on how to make qualitative analysis of a pure organic compound

-Practical knowledge on how to purify an organic compound.

## Learning Outcome

At the end of this course the students will have a strong background on identifying the properties and reactivities of aliphatic, aromatic hydrocarbons and halides from their structure. They also gain the practical knowledge on making qualitative analysis of organic compounds and their purification technique.

## Reference Books

1. Clayden J., Greeves N., Warren S. & Wothers P. “Organic Chemistry”
   1. March, "Advanced Organic Chemistry: Reactions, Mechanisms, and Structure"
2. Vogel's Textbook of Practical Organic Chemistry

# Semester III

## COURSE: CCCH6A: Organic Chemistry (Theory)

Credit 4 ; Lecture 60

### Alcohols, Phenols, Ethers and Epoxides: 8 Lectures

*Alcohols:* preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement.

*Phenols:* Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe’s–Schmidt Reactions, Fries and Claisen rearrangements with mechanism.

*Ethers and Epoxides:* Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH4

### Carbonyl Compounds: 20 Lectures

Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH4, NaBH4, MPV, PDC and PGC); Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

### Carboxylic Acids and their Derivatives: 10 Lectures

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of

dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids;

Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic sustitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangement.

### Nitrogen and Sulphur containing compounds: 10 Lectures

Preparation and important reactions of nitro and nitroso compounds, nitriles and isonitriles. Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann’s exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.

Diazonium Salts: Preparation and their synthetic applications.

Preparation and reactions of thiols, thioethers and sulphonic acids.

### Organometallic compounds of Mg, Li, Cu, B, Si\**:*\*12 Lectures

Grignard reagent; Organolithiums; Gilman cuprates: preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directed ortho metalation of arenes using organolithiums, conjugate addition by Gilman cuprates; Corey-House synthesis; abnormal behavior of Grignard reagents; comparison of reactivity among Grignard, organolithiums and organocopper reagents; Reformatsky reaction; Blaise reaction; concept of umpolung and base-nucleophile dichotomy in case of organometallic reagents.

## COURSE: CCCH6B (Organic Practical)

### Practical Organic Chemistry: Credit: 2: 60 Lecture

Identification with general reaction and tests of the following compounds

1. Methyl alcohol b) Ethyl alcohol c) Glycerol d) Acetone
2. Formic acid f) Acetic acid g) Aniline h) Nitrobenzene
3. Benzyl alcohol j) Tartartic acid k) Succinic acid l) Salicylic acid
4. Cane sugar n) Glucose m) Resorcinol

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### Learning objectives

1. To be acquainted with alcohols, phenols, ethers, epoxides and to know their chemical and physical properties.

2. To be acquainted with aldehydes, ketones and carboxylic acid derivatives and to know their chemical and physical properties.

1. To gain knowledge on the behaviour of seleveral nitrogenous compounds.
2. To get knowledge on the utility of differenct organo metallic reagents.

5. To understand the reactivity of different carbonyl compounds (aldehydes, ketones and their α,β-unsaturated analogs) towards various types of nucleophillic addition and nucleophilic addition-elimination reactions.

6. How to convert alcohols phenols, aldehydes and ketones, carboxylic acids to other derivatives and *vice-versa*.

7. How to write mechanisms of various nucleophilic addition, nucleophilic addition-elimination, nucleophilic substitution and other reactions of oxygenated and nitrogenated derivatives.

8. To understand how to use protecting group chemistry in multistep organic synthesis.

1. To identify practically some common organic compounds.

## Learning outcomes

By the end of this course, students will be able to:

1. Recognize various functional groups related to oxygenated and nitrogenated organic compounds.

2. Explain the structure and properties of oxygenated and nitrogenated compounds.

3. Predict mechanism of different reactions characteristic to oxygenated and nitrogenated compounds.

4. Identify practically some common organic compounds by exploiting their physical properties and characteristic chemical reactions.

## Recommended Texts

1. Clayden J., Greeves N., Warren S. & Wothers P. “Organic Chemistry”
2. Sykes, P. “Mechanism in Organic Chemistry” (6th ed.)

3. Dickens, T. K. and Warren, S. "Chemistry of the Carbonyl Group: A Step-by-Step Approach to Understanding Organic Reaction Mechanisms"

1. Finar, I. L. "Organic Chemistry"

5. Nad, A. K., Mahapatra, B., Ghoshal, A. "An Advanced Course in Practical Chemistry".

# Semester-IV

## CHEMISTRY-BCHC-42 (ORGANIC CHEMISTRY-IV) CCCH9A

Theory (credit: 4, 60 lectures)

### Dynamic Stereochemistry of acyclic and cyclic compounds: 14 Lecture

Conformation, reactivity and mechanism of acyclic and cyclic systems, Asymmetric synthesis and asymmetric induction, Acyclic stereoselection, Addition of nucleophiles to carbonyl compounds: 1,2-asymmetric induction, Cram's open chain, cyclic(chelate) and dipolar model, Prelogs rule. The aldol reaction. Neighbouring group participation and molecular rearrangements.

Conformation and reactivity of alicyclic compounds, effect of substituent stereochemistry on reactivity of cyclohexane derivatives, steric effect, stereoelectronic effects, reduction of cyclic ketones and reaction of cyclic epoxides, neighbouring group effects, effect of conformation on rearrangment and transannular reactions in alicyclic system, lactonization reactions of cyclohexane systems, oxidation of cyclohexanols with chromic acid, steric assistance and steric hindrence. Diastereoselection in cyclic systems: Nucleophilic addition to cyclic ketones, formation of axial and equatorial alcohols.

### Heterocyclic Compounds: 12 Lectures

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of:

Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander’s synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch Reaction; Derivatives of furan: Furfural and furoic acid.

### Alkaloids &Terpenes: 6 Lectures

Natural occurrence, General structural features, Isolation and their physiological action Hoffmann’s exhaustive methylation, Emde’s modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral and α-terpineol.

### Carbohydrates: 12 Lectures

Occurrence, classification and their biological importance.

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation;

Disaccharides – Structure elucidation of maltose, lactose and sucrose.

Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

### Polynuclear Hydrocarbons: 8 Lectures

Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

### Amino Acids, Peptides and Proteins: 8 Lecture

Amino acids, Peptides and their classification. α-Amino Acids -Synthesis, ionic properties and reactions. Zwitterions, p*K*a values, isoelectric point and electrophoresis;

Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis

## COURSE: CCCH9B ; Organic Practical (credit: 2, 60 lectures)

### Practical

1. Organic preparations:
   * Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*toluidines and *o*-, *m*-, *p*-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:
     1. Using conventional method.
     2. Using green approach
   * Benzolyation of one of the following amines (aniline, *o*-, *m*-, *p*- toluidines and *o*-, *m*-, *p*-anisidine) and one of the following phenols (β-naphthol, resorcinol, pcresol) by Schotten-Baumann reaction.
   * Oxidation of ethanol/ isopropanol (Iodoform reaction).
   * Bromination of any one of the following:
     1. Acetanilide by conventional methods
     2. Acetanilide using green approach (Bromate-bromide method)
   * Nitration of any one of the following:
     1. Acetanilide/nitrobenzene by conventional method
     2. Salicylic acid by green approach (using ceric ammonium nitrate).
   * Selective reduction of *meta* dinitrobenzene to *m*-nitroaniline.
   * Reduction of *p*-nitrobenzaldehyde by sodium borohydride.
   * Hydrolysis of amides and esters.
   * Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
   * *S*-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
   * Aldol condensation using either conventional or green method.
   * Benzil-Benzilic acid rearrangement.
2. Extraction of caffeine from tea leaves.

## Learning Objective

* To learn the conformational and configurational effects on the reactivity of acyclic and cyclic compounds.
* The course aims at giving a fundamental theoretical understanding of heterocyclic chemistry, including alternative general methods for ring synthesis and application of such methods for the preparation of specific groups of heterocyclic systems.
* Moreover, it gives the quantitative ideas about the synthesis, properties and uses of such heterocyclic compounds like pyrole, pyridine qunolene, thiophene, furan etc.
* The student will get familiar with particular properties and reactions for the most important heterocycles as well as different systems of nomenclature.
* To make students familier with the structure, properties and activities of several polynuclear hydrocarbon.
* To gain knowledge on the chemistry of several primary and secondary metabolites.

## Learning Outcome

By the end of this course the students will be able to understand the effect of 3-D structure on the reactivity of a molecule. They can understand the importance of heterocyclic moieties in chemistry. In addition they understand the structure and function of several primary and secondary metabolites obtained from plant and animals.

## Recommended Texts

1. Clayden J., Greeves N., Warren S. & Wothers P. “Organic Chemistry”
2. Eliel, E. L., "Stereochemistry of Carbon Compounds"
   1. March, "Advanced Organic Chemistry: Reactions, Mechanisms, and Structure"
3. Vogel's Textbook of Practical Organic Chemistry

# Semester V

## CHEMISTRY-BCHC-51:GROUP –B (theory-ORGANIC CHEMISTRY) (3 Credits)

Credit 2 + 1 (Tutorial) : Lecture 30 +15

### Organic Spectroscopy: 20 Lectures

General principles Introduction to absorption and emission spectroscopy.

*UV Spectroscopy:* Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

*IR Spectroscopy:* Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

*NMR Spectroscopy:* Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR for identification of simple organic molecules.

Elementary idea on mass spectrometry.

### Dyes: 5 Lectures

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes –structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples.

### Polymers: 5 Lectures

Introduction and classification including di-block, tri-block and amphiphilic polymers; Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index.

Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene);

Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.

## Learning objectives

1. To make the students familiar with the basic principles of various spectroscopic techniques (UV,IR, NMR, and MS).

1. How to analyze NMR pulse sequences using this basic NMR theory
2. How to execute basic 1-dimentional proton and carbon experiments on a standard NMR spectrometer
3. How to interpret 1-dimentional NMR spectra from simple organic compounds
4. How to apply these spectroscopic techniques in the structure elucidation of organic compounds.
5. How to analyze experimental NMR, IR, UV, and MS spectra
6. To gain knowledge on the chemistry of dyes and synthetic polymers.

## Learning outcomes

At the end of the course, the students will be able to gain knowledge of how various spectroscopic techniques are used in Organic Chemistry. Students will be well conversant with the applications of spectroscopic techniques towards the determination of molecular structures. In summary, they will learn about how to solve chemical and structural problems in a systematic manner by applying these spectroscopic techniques. In addition they will get knowledge on dyes and polymers.

## Recommended Textbook

1. Pavia, D.L., Lampman, G.M., and Kriz, G.S., "Introduction to Spectroscopy"

2. Silverstein, R.M., and Webster, F.X., "Spectrometric Identification of Organic Compounds"

1. Kemp, W. "Organic Spectroscopy"
2. Kalsi, P.S., "Spectroscopy of Organic Compounds"

# Semester VI

## GROUP –B (Theory) ORGANIC CHEMISTRY Credit 3: Lecture 45

### Pericyclic Reactions: Lecture 12

Mechanism, stereochemistry, regioselectivity in case of

*Electrocyclic reactions:* FMO approach involving 4π- and 6π-electrons (thermal and photochemical) and corresponding cycloreversion reactions.

*Cycloaddition reactions:* FMO approach, Diels-Alder reaction, photochemical [2+2] cycloadditions.

*Sigmatropic reactions:* FMO approach, sigmatropic shifts and their order; [1,3]- and [1,5]-H shifts and [3,3]-shifts with reference to Claisen and Cope rearrangements.

### Retrosynthetic analysis and functional group interconversion Lecture 12

Basic concept on retrosynthesis, disconnection approach towards synthesis of bifunctional molecules (both cyclic and acyclic), concept of synthons, synthetic equivalents, functional group interconversion, Protection and deprotection of common functional groups in synthetic route, activation of synthetic equivalents, Disconnection and synthesis of (1,3),(1,4) and (1,5)-dioxygenated compounds, Some specific examples indicating the retrosynthetic approach to design a total synthesis.

### Nucleic Acids, Enzymes and Lipids 12 Lectures

Components of nucleic acids, Nucleosides and nucleotides;

Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine;

Structure of polynucleotides.

Introduction, classification and characteristics of enzymes. Salient features of active site of

enzymes. Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition). Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

### Concept of Energy in Biosystems and Pharmaceutical Compounds 9 Lectures

Cells obtain energy by the oxidation of foodstuff (organic molecules).

Introduction to metabolism (catabolism, anabolism).

ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change.

Agents for transfer of electrons in biological redox systems: NAD+, FAD.

Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.

Overview of catabolic pathways of fat and protein.

Interrelationship in the metabolic pathways of protein, fat and carbohydrate.

Caloric value of food, standard caloric content of food types.

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

## Learning Objective

- To gain knowledge on the special class of reactions that occurs under the control of moleculear orbital symmetry.

- To understand the synthon approach in designing complex structure. Students will also learn the functional group interversion which is mandatory for designing a synthesis.

- To gain the knowledge on the fundamental biomolecular processes on which the survival of animals and plants depend.

- To gain knowledge on the structure activity relationship and the syntheses of several drug molecules.

## Learning Outcome

- While completing this course the students will have the ability to understand the basic electronic property for explaining the organic reactions. The famous orbital symetry rule enables them to interprete the behaviour of several pericyclic processes. They also have sufficient knowledge on designing a target molecule based on synthon approach. In addition students also learn several bio-molecular feature that controls the dynamics of living system.

## Recommended Texts

1. Clayden J., Greeves N., Warren S. & Wothers P. “Organic Chemistry”
2. Warren, S., "Organic Synthesis: The Disconnection Approach"

3. Silverman and Holladay, "The Organic Chemistry of Drug Design and Drug Action"

1. Berg, J. M., Tymoczko, J. L. and Stryer, L., "Biochemistry"