DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Curriculum under Choice Based Credit &

Grading System

M.Sc.

Organic Chemistry

Semester–III & Iv

run at college level from the

Academic Year 2015-16 & onwards

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of chemistry

Revised Syllabus

11.06.2015

Professor & Head
Dept. of Chemistry
Babasaheb Ambedkar
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M. Sc.III & IV semester Organic Chemistry

Effective from June 2014

The following will be the structure for revised syllabus for M. Sc. Organic Chemistry III & IV semester effective from June 2014

Semester	Paper Nos.	Title of Paper	Dura-tions (Hr)	Max. Marks	Credits
III- Semester Theory courses	CHE-313	Structural Elucidation by Spectral methods	60	50	4
	CHEO- 314	Organic Synthesis	60	50	4
	CHEO-315	Asymmetric Synthesis and Bio-Organic Chemistry	60	50	4
	CHEO-316	Photochemistry, Free Radicals And Pericyclic Reactions	60	50	4
IV semester Theory Courses	CHEO: 417	Organic Synthesis: Retrosynthetic Approach	60	50	4
	CHEO: 418	Advanced Organic and Heterocyclic Chemistry	60	50	4
	CHEO: 419	Chemistry of Natural Products	60	50	4
	CHEO: 420	Medicinal Chemistry	60	50	4
III & IV Semester Laboratory Courses	CHEO-421	Laboratory course (Organic)	135	50	4.5
	CHEO - 422	Laboratory course (Organic)	135	50	4.5
	CHEO- 423	Laboratory course (Organic)	135	50	4.5
	CHEO- 424	Project work (Organic)	135	50	4.5

Third Semester **CHE-313** **Credits: 04**

Structural Elucidation by Spectral methods

UNIT-I ***Nuclear Magnetic Resonance Spectroscopy (^1H NMR)***

Elementary ideas (Recapitulation); Spin-spin couplings, Different types of couplings, factors affecting on coupling constants, Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling, shift reagents, Nuclear Overhauser effect (NOE), INEPT and INADEQUATE.

UNIT-II ***^{13}C Nuclear Magnetic Resonance Spectroscopy***

Elementary ideas, instrumental problems, chemical shifts (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbons); Effect of substituents on chemical shifts.

UNIT-III ***Mass Spectroscopy***

Introduction, ion production (EI, CI, FD and FAB), ion analysis, ion abundance, factors affecting on fragmentation, fragmentation of different functional groups, molecular ion peak, isotopic peaks, metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.

UNIT-IV

Problems based on joint applications of UV, IR, ^1H NMR, ^{13}C NMR and Mass spectroscopy.

UNIT-V

(A) Mossbauer spectroscopy: Principle, factors affecting the line position and shape, isomer effect and Quadrupole splitting iron salt like compounds, complexes, carbonyl compounds (temperature dependence of isomer shift and Quadrupole splitting in simple compound and coordination, polynuclear complexes), Numericals.

(B) Electron Spin Resonance Spectroscopy: Introduction, principle of ESR spectroscopy, presentation of spectrum, hyperfine splitting in various structures, hyperfine splitting digram of representative examples, factors affecting the magnitude of 'g' values, Zero field splitting, Kramer's degeneracy, Anisotropy in the hyperfine coupling constant, electron delocalization, instrumentation and applications.

Reference Books:

1. Introduction to Spectroscopy: D. L. Pavia, G. M. Lampman, G. S. Kriz
2. Spectrometric Identification of Organic Compounds: R. M. Silverstein & F. X. Webster
3. ^{13}C NMR Spectroscopy: G. C. Levy, R. L. Lichter, G. L. Nelson
4. Spectroscopic Methods in Organic Chemistry: D. H. Williams & I. Flemming
5. Absorption Spectroscopy of Organic Compounds: V. M. Parikh
6. Mass Spectrometry: K. G. Das & James
7. Coordination Chemistry by Experimental Methods: K. Barger
8. Coordination Chemistry vol. I: E. Martell
9. Physical Methods for Chemistry: R. S. Drago
10. Structural Methods in Inorganic Chemistry: E. A. V. Ebsworth & D. W. H. Rankin
11. Organic Structure Analysis: Philips Crews

Third Semester **CHEO-314** **Credits: 04**

Organic Synthesis

UNIT-I *Oxidation*

(a) Oxidation of alcohol to aldehyde, ketone or acid: Jones reagent, Swern oxidation, Collins reagent, Fetizones reagent, PCC, PDC, PFC, IBX, Activated MnO_2, Chromyl chloride (Etard reaction), TEMPO, CAN, NMO, Moffatt oxidation

(b) Oxidative cleavage of Carbon-Carbon double bonds: $KMnO_4$, Ozonolysis.

(c) Allylic Oxidation: SeO_2, PhSeBr.

(d) Selective cleavages at functional groups: Cleavage of glycols, IO^-_4, $Pb(OAc)_4$.

UNIT-II *Reductions*

(a) Catalytic Hydrogenation; (b) Reduction of nitriles, oximes and nitro compounds; (c) Reduction of acids and Esters; (d) Reduction with metal hydride- Sodium cyanoborohydride, Diborane, L- & K-Selectrides, $LiBH_4$, DIBAL-H; (e) Reduction by dissolving metals- Sodium-alcohol, Sodium-Liq. Ammonia, Mg, Zinc-HCl or Acetic acid, Sn/Fe-HCl; (f) Reduction of aldehyde and ketones- Platinum, Raney nickel, $NaBH_4$, $LiBH_4$; (g) Birch reduction and related reactions, Luche reagent, Wolf-Kishner reduction, Clemmenson reduction, Wilkinson catalyst, TBTH.

UNIT-III *Organic Reagents*

Gilbert, DCC, EDC, DDQ, 1,3 Dithiane, LDA, DMDO, OsO_4, RuO_4, SmI_2, Dess-Martin Periodinane, Borane Complexes, Diazomethane, Lawesson's reagent.

UNIT-IV *Reaction Intermediates*

(a) Ylides: Preparation and their synthetic applications along with their stereochemical aspects of Phosphorous, Sulphur and Nitrogen ylides.

(b) Enamines: Generation & application in organic synthesis with mechanistic pathways, stork enamine reaction.

(c) Enolates: Generation & reaction of enolates with aldehydes and ketones, Robinson annulations, Reformatsky reaction.

UNIT-V *Formation of Carbon-Carbon bonds via organometallic reagents*

Synthesis and applications of organo Lithium, Magnesium, Titanium, Cerium, Copper, Chromium, Zinc, Boron, Silicon, Cadmium, Rhodium.

Reference Books:

1. Organic Chemistry: Clayden, Greeves, Warren and Wothers
2. Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
3. Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4. Organic Synthesis: W. Carruthers
5. Organic Reagents: Fieser & Fieser
6. Organic Synthesis: M. B. Smith
7. Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
8. Modern Organic Synthesis: An Introduction: G. S. Zweifel & M. H. Nantz
9. A Guidebook To Mechanism In Organic Chemistry: Peter Sykes
10. Organic Synthesis Concepts, Methods, Starting Materials: J. Fuhrhop, G. Penzlin
11. Organic Chemistry: An Intermediate Text: Robert V. Hoffmann
12. Advanced Organic Chemistry: Jerry March
13. Organic Synthesis: R. O. C. Norman and Coxan
14. Name Reactions: Jie Jack Li

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Third Semester **CHEO-315** **Credits: 04**

Asymmetric Synthesis and Bio-Organic Chemistry

UNIT-I ***Introduction to Bioorganic chemistry***

Basic concepts, Proximity effects in organic chemistry, Molecular adaptation, Molecular recognition.

UNIT-II ***Enzyme Chemistry***

Nomenclature, Classification and Extraction of enzymes, Structural outlines of enzymes (proteins); Introduction to catalysis and enzymes; Multifunctional catalysis, Intramolecular Catalysis, Molecular asymmetry and prochirality, Mechanism of enzyme action, Factors responsible for enzyme specificity, Enzyme activity and kinetics (Michaelis Menten and Lineweaver–Burk plots), Enzyme Inhibitions (Reversible and irreversible), Structure, Mechanism of action and applications of α-Chymotrypsin, Ribonuclease, lysozyme and Carbopeptidase-A. Enzymes in synthetic organic chemistry. [Additions, eliminations, substitutions, condensations, cyclocondensations, oxidations, reductions and rearrangement reactions are to be covered]

UNIT-III ***Co-Enzyme Chemistry***

Introduction to co-enzymes, Cofactors, prosthetic groups and apoenzymes, Chemical structures of co-enzymes and cofactors, Oxidoreduction (NAD^+, $NADP^+$), Pyridoxal phosphate (PLP), Thiamine pyrophosphate (TPP), Biotin (CO_2 carrier), Haemoglobin (O_2-carrier), Flavin (FMN, FAD, $FADH_2$), Oxene Reactions, Lipoic acid, Mechanisms of reactions catalyzed by co-factors.

UNIT-IV Supramolecular Chemistry and Biomimetic Chemistry (Enzyme Models)

Host-Guest approach, Chiral recognition, Designing Enzyme Models, Ionophores, Crown ethers, cryptands, Micelles, Cyclodextrins, calixarenes.

UNIT-V ***Asymmetric Synthesis***

Chiral pool, Chiral auxiliary, Enantio- & Diastereoselective synthesis, Chiral reagent and chiral catalyst including CBS reagent, NADH, Asymmetric hydrogenation including BINAP, Hydroboration- Ipc_2BH, $IpcBH_2$, Asymmetric epoxidation- (+) DET & (-) DET, Sharpless, Jacobson, Asymmetric dihydroxylation- $(DHQD)_2PHAL$ & $(DHQ)_2PHAL$, Felkin-Anh model, Zimmermann-Traxler transition state model, Proline catalyzed asymmetric reactions.

Reference Books:

1. Bioorganic chemistry (A chemical approach to enzyme action): Hermann Dugas.
2. Biotransformation in Organic chemistry: K. Faber.
3. Enzyme structure and Mechanism: Alan Fersht.
4. Enzyme catalysis in organic synthesis vol.1: Karlheinz Drauz and Herbert Waldmann.
5. Bioorganic, Bioinorganic and supramolecular chemistry: P. S. Kalsi and J. P. Kalsi.
6. Organic chemistry IVth Edn.: G. Marc Loudon.
7. Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
8. Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
9. Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
10. Organic Chemistry: Clayden, Greeves, Warren and Wothers
11. Organic Synthesis: W. Carruthers
12. Organic Synthesis: M. B. Smith

Third Semester **CHEO-316** **Credits: 04**

Photochemistry, Free Radicals And Pericyclic Reactions

UNIT-I *Pericyclic Reactions-I*

Features and classification of pericyclic reactions, Phases, nodes and symmetry properties Of molecular orbital in ethylene, 1,3-butadiene, 1,3,5-hexatriene. Allyl cation, allyl radical, pentadienyl cation and pentadienyl radical. Thermal and photochemical reactions.

Electrocyclic reactions: Con-rotation and dis-rotation, electrocyclic closure and opening in 4n and 4n+2 systems, Woodward-Hoffmann selection rules for electrocyclic reactions. Explanation for the mechanism of electrocyclic reactions by: (i) Symmetry properties of HOMO of open chain partner; (ii) Conservation of orbital symmetry and orbital symmetry correlation diagram and (iii) Huckel-Mobius aromatic and antiaromatic transition state method.

UNIT-II *Pericyclic Reactions-II*

Cycloaddition reactions: Suprafacial and antarafacial interactions. (π) and (π cycloadditions. Cycloreversions. Stereochemical aspects in supra–supra, antara-supra and antara-antara (π and (π cycloadditions. Diels-Alder reaction. Woodward-Hoffmann selection rules for cycloaddition reactions. Explanation for the mechanism of cycloaddition reactions by 1) Conservation of orbital symmetry and orbital symmetry correlation diagrams 2) Fukui Frontier Molecular Orbital (FMO) theory and (3) Huckel-Mobius aromatic and antiaromatic transition state method. Endo-exo selectivity in Diels-Alder reaction and it's explanation by FMO theory. Examples of cycloaddition reactions.

Sigmatropic reactions: [1,j] and [i,j] shifts. Suprafacial and antarafacial shifts. Selection rules for [i,j] shifts. Cope, degenerate Cope and Claisen rearrangements. Explanation for the mechanism of sigmatropic reactions by 1) symmetry properties of HOMO 2) Huckel-Mobius aromatic and antiaromatic transition state method. Introduction to chelotropic reactions and the explanation of mechanism by FMO theory.

UNIT-III *Photochemistry-I*

Photochemistry of (π, π^*) transitions: Excited state of alkenes, cis-trans isomerisation, photochemistry state, electrocyclisation and Sigmatropic rearrangements, di π-methane rearrangement.

Intermolecular reactions: photocycloadditions, photodimerasation of sample and conjugated olefins, addition of olefins to α, β unsaturated carbonyl compounds, excimers and exiplexes. Photoaddition reactions. Excited states of aromatic compounds, photodimerisation of benzene, photosubstitution reactions of aromatic compounds and Photo-Fries rearrangement.

UNIT-IV *Photochemistry-II*

Photochemistry of (n, π^*) transitions: Excited state of carbonyl compounds, hemolytic cleavage of α-bond-Norrish type I reaction in acyclic, cyclic ketones and strained cycloalkanediones.

Intermolecular abstraction of hydrogen: Photo reduction and photo oxidation-influence of temperature, solvent, nature of hydrogen donors and structure of the substrate.

Intramolecular abstraction of hydrogen: Norrish type II reaction in ketones, esters and 1, 2-diketones.

Addition to C-C multiple bonds: Paterno-Buchi reaction, photodecarboxylation, photochemistry of alkyl peroxides, hypohalites and nitriles. Barton reaction. Photochemistry of azo compounds, diazo compounds, azides and diazonium salts. Singlet oxygen-photo oxygenation reactions. Ene reaction, formation of dioxetanes and endoperoxides. Chemiluminescent reactions. Oxidative coupling.

UNIT-V *Free radical reactions*:
Introduction, generation, stability, reactivity, characteristics, structural and stereo chemical properties of free radicals. Persistent free radicals.
Reaction of free radicals: Addition, substitutions, fragmentations (Norrish-I, II, Mclafferty rearrangement), Oxidations and reductions, Neighbouring group assistance. Detection of free radicals, Homolysis and free radical displacement. Radical chain reactions, Addition and rearrangements, radical cyclization, reactivity of aliphatic and aromatic substrates at bridgehead, Coupling of alkynes and arylation of aromatic compound by diazonium salt, Sandmeyer reaction, Hunsdieker reaction, Allylic halogenations, McMurry reaction, Acyloin condensation, Birch reduction, Bouveault-Blank reduction.

Reference Books:
1. Advanced Organic Chemistry Part A & Part B: F. A. Carey & R. J. Sundberg
2. Advanced Organic Chemistry: Jerry March
3. Organic Chemistry: Clayden, Greeves, Warren & wother.
4. Organic Chemistry: Stanley H. Pine
5. Organic Synthesis: W. Carruthers
6. Organic Synthesis: Norman and Coxon

Fourth Semester **CHEO-417** **Credits: 04**

Organic Synthesis: Retrosynthetic Approach

UNIT-I *Disconnection Approach*

Introduction to:

(i) Grounding of organic chemistry for understanding retrosynthesis;

(ii) Retrosynthetic analysis and designing of the synthesis;

(iii) Disconnection approach: An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversions, importance of order of events in organic synthesis, one and two group C-X disconnections, selective organic transformations: chemoselectivity, regioselectivity, stereoselectivity, enentioselectivity, Reversal of polarity, cyclization reactions, amine synthesis.

UNIT-II *Protecting Groups*

Protection and deprotection of hydroxyl, carbonyls in aldehydes and ketones, amines, carboxylic acids, alkenes and alkynes.

UNIT-III *C-C Disconnections*

(i) One group C-C Disconnections:

Alcohols (including stereoslectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

(ii) Two group C-C Disconnections:

Diels-Alder reactions, 1,3 difunctionalized compounds and α, β-unsaturated compounds, control in carbonyl condensations, 1,5 difunctionalized compounds, Michael addition and Robbinson annealation.

UNIT-IV *Ring Synthesis*

Introduction to ring synthesis, saturated heterocycles, synthesis of 3, 4, 5 and 6 membered rings, rearrangements and photochemistry in synthesis, aromatic heterocycles.

UNIT-V *Complex molecules*

Synthetic routes based on retrosynthetic analysis for following molecules:

Longifoline, Reserpine, Juvabione, Amphidicoline, Taxol.

Reference Books:

1. Organic Synthesis: The Disconnection Approach: Stuart Warren
2. Designing Organic Synthesis: Stuart Warren
3. Organic Synthesis: Strategy and Control: Paul Wyatt and Stuart Warren
4. The Logic of Chemical Synthesis: E. J. Corey and Xue-Min Chelg
5. Classics in Total Synthesis I, II and III: K. C. Nicolaou and others
6. Organic Synthesis Concepts, Methods, Starting Materials: J. Fuhrhop, G. Penzlin
7. Some Modern Methods of Organic Synthesis: W. Carruthers
8. Organic Synthesis: M. B. Smith
9. Principles of Organic Synthesis: R. Norman and J. M. Coxan.
10. Advanced Organic Chemistry: Jerry March
11. Organic Chemistry: Clayden, Greeves, Warren and Wothers

Fourth Semester **CHEO-418** **Credits: 04**

Advanced Organic and Heterocyclic Chemistry

PART A: *Advanced Organic Chemistry*

UNIT-I *Rearrangements*

Pummerer, Payne, Eschenmoser fragmentation, Brook, Anchimeric assistance (Neighbouring group participation) related rearrangement, Wagner-Meerwein, Wolf, Semipinacol, Epoxide rearrangement with lewis acid, Dienone-Phenol rearrangement, Tiffeneau-Demjanov, Favorskii, von Richter, Wittig, Neber, Smiles, Fries, Curtius, Lossen, Schmidt, Steven, Hofmann, Iodolactonisation.

UNIT-II *Name Reactions*

Arndt-Eistert, Hunds-Diecker reaction, Baeyer-Villiager, Dakin, Gabriel synthesis, Michael, Darzen, Prins, Henry, Reimer-Tiemann, Hoffmann–Loffler–Freytag, Dieckmann cyclization, Chichibabin, Vilsmeier, Ene, Ullmann reaction, Mannich, Strecker amino acid synthesis. Bamford-Steven, Baylis-Hillmann, Corey-Fuchs Reaction, Julia Olefination, Mukaiyama aldol, Mitsunobu, Peterson olefination, Corey-Winter olefination, Woodward and Prevost dihydroxylation, Shapiro, Ritter, Stille, Heck, Sonogashira, Suzuki, Duff, Chugaev, Petasis, McMurry reaction and Coupling. Ring closing metathesis (Grubb's metathesis), Aldol-Tishchenko reaction (Evans-Tishchenko reaction), Ugi, Passerini, Biginelli, Hantzsch condensation.

Reference Books:

1. Organic Chemistry: Clayden, Greeves, Warren and Wothers
2. Organic Synthesis: W. Carruthers
3. Organic Synthesis: M. B. Smith
4. Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
5. Modern Organic Synthesis: An Introduction: G. S. Zweifel & M. H. Nantz
6. Organic Synthesis Concepts, Methods, Starting Materials: J. Fuhrhop, G. Penzlin
7. Name Reactions and Reagents in Organic Synthesis: B. P. Mundy, M. G. Ellerd, F. G. Favaloro
8. Organic Chemistry: An Intermediate Text: Robert V. Hoffmann
9. Multicomponent Reactions: J. Zhu, H. Bienayme (Wiley-VCH)
10. Advanced Organic Chemistry: Jerry March
11. Organic Synthesis: R. O. C. Norman and Coxan
12. Name Reactions: Jie Jack Li

PART A: *Heterocyclic Chemistry*

UNIT-I Nomenclatures of all types of heterocycles, Classification of heterocycles: as aromatics based upon various membered ring systems.

UNIT-II .General synthetic routes based on name reactions, reactivities, utilities and wherever possible spectral analyses of the following class of heterocycles. **Four membered**: Azitidines, including β- lactums. **Five membered:** Thiazoles, Oxazoles, Pyrazoles and Imidazoles.

Six membered: Pyridines, Pyrimidines. **Fused heterocycles**: Flavones, Chromones, Coumarines, Indoles, Quinolines, Benzodiazepines, and Phenothiazines.

Reference Books:

1. Heterocyclic Chemistry: vol. I, II, III: R. R. Gupta, M. Kumar and M. Gupta
2. Heterocyclic Chemistry: Joules and Mills
3. Modern heterocyclic Chemistry: L. A. Paquette (Benjamin)
4. Organic Chemistry: Jonathan Clayden

Fourth Semester **CHEO-419** **Credits: 04**

Chemistry of Natural Products

UNIT-I *Terpenoids & Carotenoids*

Classification, Nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule

Structure determination, stereochemistry, and synthesis of the following representative molecules: Citral, Geraniol, α-Terpineol, Menthol, Farnesol, Zingiberene, Phytol, Abietic acid and β- Carotene.

UNIT-II *Alkaloids*

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants.

Structure, stereochemistry and synthesis of the following:

Ephedrine, (+)-coniine, nicotine, atropine, Quinine and Morphine.

UNIT-III *Steroids*

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Bile acids, Androsterone, Testosterone, Estrone, Progestrone.

UNIT-IV *Anthocyanins and Flavones*

Occurrence, nomenclature and general methods of structure determination.

Synthesis of cyanidin chloride, cyanin, Hirsutidin chloride, Flavones (Kostanecki and Baker-Venkataraman approaches), Flavonols, Qurcetin, and Isoflavones.

UNIT-V *Biogenesis*

The building blocks and construction mechanisms of the following

(a) Terpenoids: Mono-, Sesqui-, Di-, Tri-Terpenoids and steroids.
(b) Alkaloids: pyridine alkaloids, Benzyl Isoquinoline alkaloids, morphine alkaloids and Indole alkaloids.
(c) The Shikimic acid pathway.

Reference Books:

1. The Organic Chemistry of Drug Design and Drug Action: R. B. Silverman, Academic press.
2. Natural Products: Chemistry and Biological Significance: J. Mann, R. S. Davidson, J. B. Hobbs, D. V. Banthrope and J. B.Harborne, Longman, Essex.
3. Organic Chemistry: Vol. II, I. L. Finar, ELBS.
4. Introduction to Flavonoids: B. A. Bohm, Harwood Academic Publishers
5. New Trends in Natural Product Chemistry: Atta-ur-Rahman and M. I. Choudhary, Harwood Academic publishers.
6. Biogenesis of Natural Products: Baldev Kumar and Harishkumar Chopra (Narosa Publication)

Fourth Semester **CHEO-420** **Credits: 04**

Medicinal Chemistry

UNIT-I Basic consideration of drug activity

Definition and Introduction of following terms-Drug, Prodrug, Hard and Soft drugs, agonists, antagonists, affinity, efficacy, potency, isosterism, bioisosterism, pharmacophores, lead molecule, lethal dose (LD50) and effective dose (ED50) (i) Factors affecting bioactivity, (ii) Theories of drug activity, (iii) Structure activity relationship (SAR), QSAR (2D and 3D method) and Hantzsch equation (iv) Drug receptor mechanism.

UNIT-II *Pharmacokinetics*

(i) Drug absorption, Distribution and deposition of drugs.

(ii) Excretion and elimination of drugs, Bioavailability.

UNIT-III *Pharmacodynamics*

(i) Mechanism of drug action: Enzyme stimulation and enzyme inhibition, antimetabolites, membrane active drugs, chelation; (ii) Drug metabolism and inactivation: Factors affecting drug metabolism, pathways of drug metabolism [Metabolic reaction (Phase I) and conjugation reaction (Phase II)].

UNIT-IV *Classification of Drugs*

The detail contents of the each class of the drugs.

UNIT-V

Synthesis and Utilities of the following drug molecules (at least one convenient synthetic route with possible mechanism) from following classes:

I. Anti inflammatory Drugs: (a) Naproxen (b) Ibuprofen (c) Oxaprozin (d) Diclofenac Sodium (e) Rofecoxib (f) Celecoxib.

II. Anti-hypertensive Drugs: (a) Verapamil (b) Captopril (c) d-sotalol (d) Atenolol (e) Diltiazem (f) Semotiadil fumarate.

III. Drugs acting on CNS: (a) CNS Stimulant : Dextro-amphetamine

(b) Respiratory Stimulant : Doxapram

(c) CNS anti-depressant : (i) Chlorpromazine (Antipsychotic) (ii) Diazepam (Anxiolytic) (iii) Phenobarbitol (Antiepileptic)

IV Anesthetic Drugs:

(a) General : Ketamine (b) Local : (i) Lidocaine (ii) Procaine

V. Antibiotics: (a) Chloramphenicol (b) Ampicillin (c) Amoxycillin (d) Cefepime (e) Cefpirome (f) Antimycobactrial: Ethambutol (g) Antiviral: Acyclovir (h) Antimicrobial: Sulfamethoxazole

VI. Antidiabetics : (a) Troglitazone (b) Chlorpropamide (c) Tolbutamide

VII. Antineopastic Drugs: (a) Antagonist: Fluorouracil (b) Alkylating agents: i) Chlorambucil (ii) Cis-Platin

Reference Books:

1. FOYE'S Principles of Medicinal Chemistry VIth Edition: Thomas L. Lemke, David A. Williams, Victoria F. Roche and S. William Zito.
2. Introduction of Medicinal Chemistry: A. Gringuage, Wiley-VCH.
3. Synthesis of Essential Drugs: R. S. Vardanyan and V. J. Hruby.
4. Volumes of Burger's Medicinal Chemistry: M. E. Wolf, JohnWiley.
5. Medicinal Chemistry: David J. Triggle.
6. Essentials of Medicinal Chemistry IInd: Andrejus Korolkovas, WileyVCH.

Organic Chemistry
LABORATORY COURSES

CHEO-421 **Duration: 4.5 Hrs/Week** **Credits: 4.5**

Qualitative analysis of ternary mixtures.

In a mixture at least one liquid, one water soluble compound be given.

CHEO-422 **Duration: 4.5 Hrs/Week** **Credits: 4.5**

Organic multistep preparations.

Preparations involving at least two stage based on name reactions, condensations, cyclocondensations, reagents and rearrangements (as covered under the theory). Separation, purification of the product by column is desired.

CHEO-423 **Duration: 4.5 Hrs/Week** **Credits: 4.5**

(A) Preparations involving one stage based upon the green synthetic protocols (as covered in theory syllabus).

(B) Structure elucidation of organic compounds by spectral analyses.

CHEO-424 **Duration: 4.5 Hrs/Week** **Credits: 4.5**

Project work: Dissertation be prepared and should contain literature survey, aim, scope of the project, experimental details and concluding discussions.

Reference Books:

1. Textbook of Practical Organic Chemistry: Vogel
2. Organic Synthesis Collective Volumes: Blatt
3. Research Periodicals including internet services.