

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY



CIRCULAR NO.SU./M.Sc.CBC & GS/14/2022

It is hereby inform to all concerned that, on the recommendation of Dean, Faculty of Science & Technology, **the Academic Council at its meeting held on 29 August 2022 has accepted the following Syllabi of M.Sc. Post Graduate Degree Courses under Choice Based Credit & Grading System to the affiliated Colleges and University Departments** as appended herewith:-

Sr.No.	Name of the Degree	Semester
1.	M.Sc. Environmental Science	IIIrd and IVth semester
2.	M.Sc. Biophysics	Ist to IVth semester
3.	M.Sc.Organic Chemistry	IIIrd and IVth semester
4.	M.Sc.Analytical Chemistry	IIIrd and IVth semester
5.	M.Sc.Drug Chemistry	IIIrd and IVth semester

This shall be effective from the Academic Year 2022-23 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.No. SU/SCI/2022/8467-74
Date:- 30.08.2022.

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*Deputy Registrar,
Academic Section.*

Copy forwarded with compliments to :-

- 1] **The Principal of all concerned affiliated Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
- 2] **Head of the Department,**
Dr.Babasaheb Ambedkar Marathwada University, Aurangabad.
- 3] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.BAMU, A'bad.
- 2] The Section Officer, [M.Sc.Unit] Examination Branch, Dr.BAMU, A'bad.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU, A'bad.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU, A'bad.
- 5] The In-charge, [E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU, A'bad.
- 6] The Public Relation Officer, Dr.BAMU, A'bad.
- 7] The Record Keeper, Dr.BAMU, A'bad.

DR. BABASAHEB AMBEDKAR MARATHWADA
UNIVERSITY, AURANGABAD.

DEPARTMENT OF CHEMISTRY



SYLLABUS

M. Sc. Drug Chemistry
(Semester III & IV)

Choice Based Credit and Grading System
(Common for University Department & All Colleges)

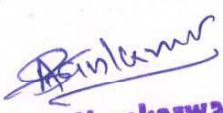
Effective from June 2022

Anil G. Shankarwar
(Dr. Anil G. Shankarwar)
Chairman BOS Chemistry
Dr. Babasaheb Ambedkar Marathwada University
Aurangabad.

The following will be the Choice Based Credit and Grading System structure of revised syllabus for M. Sc. III & IV semester Drug Chemistry effective from June 2022.

Semester	Paper Nos.	Title of Paper	Teaching (hr)/week	Marks	Credits
III- Semester (Theory)	CHESC -313 Common Service Course	Structural elucidation by spectral methods	04	100	04
	CHED-314	Advanced Organic Chemistry - I	04	100	04
	CHED-315	Introduction to Medicinal Chemistry	04	100	04
	CHED-316	Advanced Organic Chemistry - II	04	100	04
IV semester (Theory)	CHED -417	Drug Synthesis	04	100	04
	CHED -418	Advanced Organic Chemistry - III	04	100	04
	CHED -419	Drug Action & Development	04	100	04
	CHED -420(A)	Pharmaceutical & Industrial Practices OR	04	100	04
	CHED -420(B)	Bio-organic & Green chemistry	04	100	04
	CHED -420(D)	Drug design and drug discovery	04	100	04
III & IV Semester Laboratory course	CHED -421	Laboratory course (Drug Synthesis)	4.5	50	06
	CHED -422	Laboratory course (Drug Assay)	4.5	50	06
	CHED -423	Laboratory course [Research project (Experimental) & Spectral Analysis]	4.5	50	06
	CHED -424	Research project (Dissertation, Presentation and Seminars)	4.5	50	06

Practical examination of III and IV Semester will be conducted at the end of the fourth semester theory examination


(Dr. Anil G. Shankarwar)
 Chairman BOS Chemistry
 Dr. Babasaheb Ambedkar Marathwada University
 Aurangabad.

CHESC-313: Structural elucidation by spectral methods
(Common Service Course)

04 Hrs/Week

Credits: 04

Marks 100

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

[12 hrs]

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

[12 hrs]

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

UNIT-III: Mass Spectrometry

[12 hrs]

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

[12 hrs]

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

UNIT-V

[12 hrs]

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.

Electron Spin Resonance Spectroscopy: Principle of ESR spectroscopy, presentation of spectrum, hyperfine splitting in various structures, hyperfine splitting diagram 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

CHED-314: Advanced Organic Chemistry - I

04 Hrs/Week

Credits: 04

Marks 100

UNIT-I Oxidation

[12 hrs]

- (a) Oxidation of alcohol to aldehyde, ketone or acid: Jones reagent, Swern oxidation, Collins reagent, Fetizon's 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) Oxidations using SeO_2 , PhSeBr .
- (d) Selective cleavages at functional groups: Cleavage of glycols, IO_4^- , $\text{Pb}(\text{OAc})_4$

UNIT-II Reductions

[12 hrs]

- (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) Birch reduction and related reactions, (h) Luche reagent, Wolf-Kishner reduction, Clemmenson reduction, Wilkinson catalyst, TBTH.

UNIT-III Organic Reagents

[12hrs]

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

UNIT-IV

[12 hrs]

(A) Ylides and Enamines

- (i) Ylides: Preparation and their synthetic applications along with their stereochemical aspects of Phosphorous, Sulphur and Nitrogen ylides.
- (ii) Enamines: Generation & application in organic synthesis with mechanistic pathways, Stork enamine reaction.
- (iii) Enolates : Generation & reaction of enolates with aldehydes and ketones, Robinson annulations, Reformatsky reaction

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

[12 hrs]

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

CHED-315: Introduction to Medicinal Chemistry

04 Hrs/Week

Credits: 04

Marks 100

Unit I: Introduction to Drug

30 Hrs

What are Drugs? Definition, Characteristics of ideal drugs, Why do you need drugs?

- (A) Classification of Drugs: i) Based on the chemical structures; examples of each class; ii) Based on the Pharmacological action; examples of each class, Physiological action
- (B) Sources of Drugs: i) Plant sources; examples of methods of isolation; ii) Marine sources; examples of methods of isolation; iii) Micro-organism sources; examples of methods of isolation
- (C) Historical development of Medicinal Chemistry, Genetic engineering
- (D) Development of drugs: Lead discovery, lead development; Pharmacological / Microbiological / Biochemical evaluation of drugs; Clinical trials; Pharmacokinetic: i) Absorption, ii) Distribution, iii) Metabolism, iv) Elimination
- (E) Dosage forms; Need and Benefits; Mode of administration of drugs; Types, Advantages; Disadvantages.
- (F) Drug Toxicity and its prevention: Principles of toxicology, abnormal action of drugs such as tolerance, addiction, habituation, idiosyncrasy, allergy, hypersensitivity, antagonism, synergism, potentiation, tachyphylaxis. Adverse drug reactions and its monitoring.

Unit II Pharmacodynamics and Pharmacokinetics

30 Hrs

- (A) Pharmacodynamics: Principles, site and mechanism of drug action (Nervous system, Histamines and Antihistamines, Cardiovascular Drugs), Drug Receptor, Classification of receptors, Drug-Receptor interactions, Theories of Drugreceptor interactions. Determination of B-max and Kd by transforming data with hill plot and Scatchard plot, above concepts with special reference to opioid, adrenergic and GABA energetic receptors, GPCRS receptors.
- (B) Dose response relationship, Therapeutic index, combined effects of drugs and factors modifying drug action. LD50, ED50, LC50, EC50, MIC and MEC. Adverse Drug Reactions. Pharmacovigilance, ADR monitoring.
- (C) Pharmacokinetics: Importance of pharmacokinetics in drug discovery, Concept of pro-drug and soft drug.
- (D) Pharmacokinetic properties, Membrane transport, absorption, distribution metabolism and excretion of drugs (ADME parameters), Factors affecting ADME, Lipinski's rule of five. Kinetics of elimination

Reference books:

- 1) Medicinal chemistry (Vol. I and II)-Burger.
- 2) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
- 3) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
- 4) Medicinal Chemistry- Ashutosh Kar

- 5) Medicinal Chemistry- Balkishen Razdan
- 6) Natural Products: Chemistry and Applications- S.V. Bhat, B.A. Nagasampagi, S. Meenakshi
- 7) Medicinal Chemistry an Introduction-Gareth Thomas 2nd Ed. Wiley
- 8) An introduction to medicinal chemistry-Graham L. Patrick 5th Ed. Oxford
- 9) Introduction to Medicinal Chemistry-Alex Gringauz (Wiley)
- 10) Comprehensive Medicinal Chemistry Vol-I (Hansch (1990) Pergamon press
- 11) Principle of Drug action-Goldstein.
- 12) Bioavailabinty and Bio equivalence-H.P.Tinis.
- 13) V. K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Anes Student Edition, 2008
- 14) S. K. Gupta, Drug screening methods, New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2004.
- 15) Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 1995.
- 16) A. Gringuage, Introduction to Medicinal Chemistry, Wiley-VCH, 1997.
- 17) E. Stevens, Medicinal Chemistry-The Modern Drug Discovery Process, Pearson, 2014.
- 18) R.S. Satoskar, S. D. Bhandarkar, Pharmacology and Pharmacotherapeutics, Popular Prakeshan, 21st edn., 2009.

CHED-316: Advanced Organic Chemistry - II

04 Hrs/Week

Credits: 04

Marks 100

UNIT-I: Pericyclic Reactions-I

[12 hrs]

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: 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

[12 hrs]

Cycloaddition reactions: 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 its explanation by FMO theory. Examples of cycloaddition reactions.

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

UNIT-III: Photochemistry-I

[12 hrs]

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

Intermolecular reactions: photocycloadditions, photodimerasation. Photoaddition reactions. Excited states of aromatic compounds, photodimerisation of benzene, photosubstitution reactions of aromatic compounds and Photo-Fries rearrangement.

UNIT-IV: Photochemistry-II

[12 hrs]

Photochemistry of (n , π^*) transitions: Excited state of carbonyl compounds, Norrish-I and

Norrish-II

Addition to C-C multiple bonds: Paterno-Buchi reaction, 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

[12 hrs]

Introduction, generation, stability, reactivity, characteristics, structural and stereo chemical properties of free radicals, Persistent free radicals.

Reaction of free radicals: Addition, substitutions, fragmentations, Oxidations and reductions, 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 & Wothers.
4. Organic Chemistry: Stanley H. Pine
5. Organic Synthesis: W. Carruthers
6. Organic Synthesis: Norman and Coxon

CHED-417: Drug Synthesis

04 Hrs/Week

Credits: 04

Marks 100

Chemical synthesis of different classes of drugs:

Unit I: Anti-Infective

10Hr

Introduction, Different classes, Mode of action examples of synthesis of each class e.g. Penicillin, Cephalosporins (semi-synthetic), Chloramphenicol, Ciprofloxacin, Sulphonamides, Metronidazole, Clotrimazole, Griseofulvin

Unit II: Psychoactive Drugs

10Hr

Introduction, neurotransmitters, CNS depressant, general anaesthetics, mode of action of hypnotics, sedatives, anti-anxiety drugs, synthesis of some psychoactive drugs e.g. Diazepam, Barbiturates, Fluoxetine, Alprazolam.

Unit III: Cardiovascular drugs

10Hr

Introduction, Cardiovascular diseases, Drug inhibitors of peripheral sympathetic function, central intercession of cardiovascular output, direct acting anterior dilators, synthesis of some cardiovascular drugs e.g. Atenolol, Captopril, Diltiazem, Reserpine, Prostaglandins.

Unit IV: Anti-neoplastic agent

10Hr

Introduction, cancer chemotherapy, special problems; Role of alkylating agent and anti-metabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors, synthesis of some antineoplastic agent-e.g. Taxol.

Unit V: Analgesics and Anti-inflammatory

12Hr

Introduction, Synthesis of some: Analgesis and Anti-inflammatory compounds e.g. Ibuprofen, Indomethacin, Diclofenac, Rofecoxib, Steroids: Introduction, Nomenclature, Structure elucidation Cholesterol, Bile acids, Estrogens, Gestogens, Androgens, Cortisone, Vitamins: A, D, E, K, Vitamin B, Complex, B₁, B₂, B₆, B₁₂, C, H.

Unit VI: Antiacids / Antiulcer

08Hr

Introduction, synthesis: Omeprazole, Ranitidine.

Reference Books:

1. Synthesis of Essential Drugs- R. S. Vardanyan and V. J. Hruby, *Elsevier*.
2. Contemporary Drug Synthesis- J. J. Li, D. S. Johnson, D. R. Sliskovic, B. D. Roth, *John Wiley*.
3. Natural Products Chemistry- J. Singh, S. M. Alia and J. Singh, *Pragati Prakashan*.
4. Principals of Organic Synthesis- R. O. C. Norman and J. M. Coxon, *CRC Press*.
5. Advanced Organic Chemistry *Part B: Reactions and Synthesis*- F. A. Carey and R. J. Sundberg, *Springer*.
6. Natural Products: Chemistry and Applications- S.V. Bhat, B.A. Nagasampagi, S. Meenakshi.
7. Medicinal chemistry (Vol. I and II)-Burger.
8. The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
9. Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
10. Medicinal Chemistry- Ashutosh Kar
11. Medicinal Chemistry- Balkishen Razdan

CHED-418 : Advanced Organic Chemistry - III

04 Hrs/Week

Credits: 04

Marks 100

UNIT- I Rearrangements

[15 hrs]

Pummerer, Payne, Eschenmoser fragmentation, Brook, 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 - I

[15 hrs]

Arndt-Eistert, Hunsdiecker reaction, Baeyer-Villiger, Dakin, Gabriel synthesis, Michael, Darzen, Prins, Henry, Reimer-Tiemann, Hoffmann-Löffler-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.

UNIT-III: Name Reactions - II

[15 hrs]

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 (Grubbs' metathesis), Aldol- Tishchenko (Evans-Tishchenko reaction), Ugi, Passerini, Biginelli, Hantzsch condensation.

UNIT-IV: Asymmetric Synthesis

[15 hrs]

Chiral pool, Chiral auxiliary, Enantio- & Diastereoselective synthesis, Chiral reagent and chiral catalyst including CBS reagent, NADH, Asymmetric hydrogenation including BINAP, Hydroboration- Ipc₂BH, IpcBH₂, 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. Organic chemistry IVth Edn.: G. Marc Loudon.
2. Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
3. Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4. Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
5. Organic Chemistry: Clayden, Greeves, Warren and Wothers
6. Organic Synthesis: W. Carruthers
7. Organic Synthesis: M. B. Smith
8. Name Reactions: Jie Jack Li
9. Name Reactions and Reagents in Organic Synthesis: B. P. Mundy, M. G. Ellerd, F. G. Favaloro

CHED-419: Drug Action & Development

04 Hrs/Week

Credits: 04

Marks 100

Unit I: Drug Design- A Rational Approach

10 Hrs

Introduction, Analogous and prodrugs, Concept of lead, Factors governing drug-design, Rational Approach to drug-design, Drug design-methods of variations, Drug design and development, Molecular hybridisation, rigidity and flexibility vs Drug-design.

Unit II: Physical-Chemical Factors and Biological Activities

10 Hrs

Introduction, Physical properties, Factors governing ability of drugs, Dissociation constants, Isosterism and bio-isosterism, Stereochemistry and drug action, Chemical properties.

Unit III: Target of action of drugs

10 Hrs

- a) **Receptors:** Definition, mode of action: agonists, antagonists (description): Families of receptors
- b) **Cell:** Definition, types, structure
- c) **Nucleus:** Definition, types, nucleic acid, DNA (structure, drug, that work on DNA); RNA (structure, that work on RNA) Drugs related to nucleic acid and building blocks.

Unit IV: Mode of action and development of following classes of drugs

20 Hrs

- a) Cancer and anticancer drugs: Mechloroethamines hydrochlorides, Chloroambucil, Methotrexate, Daunorubicin, Colchicine.
- b) Analgesics and anti-inflammatory: Indomethacin, Ibuprofen, Ibufenac, Indoprofen, Naproxen.
- c) Antibiotic-Historical development and semi synthesis e.g. Penicillin, Cephalosporin's, Macrolides, Quinolones, Sulphonamides and sulphones
- d) Anti-malarials: Chloroquine phosphate, Pamaquine, Pyrimethamine, Dapsone, Trimethoprim.
- e) Anti-virals and AIDS: Amantidine hydrochloride, Idoxuridine, Acyclovir, Ribavirin, Vitrasert, foscarnet.
- f) Anti-fungals: Griseofulvin, Chlorimidazole, Naftifine, Flucytosine.
- g) Cardiovascular disorders and managements: Hypertension, Myocardial infraction, angina, Arrythemia: Hydralazine, Clonidine, Diazoxide, Sodium nitroprusside, Propranolol.
- h) Antidiabetics: Chlorpropamide, Metformin, Nateglinide, Rosiglitazone, Pioglitazone
- i) Central nervous system and disorder managements Anticonvulsant, Antidepressant, Sedatives: Caffenie, Theobromine, Pemoline, Phentermine, Bemegride.

Unit V: Enzymes and Enzyme Inhibition

10 Hrs

- a) Introduction to Enzymes – Definition, Structure, Types; b) Mode of Action – Theory, Regulating Enzyme Activity, Proenzymes. Enzyme kinetics, Michaelis–Menten Equation, Lineweaver–Burk Equation; c) Enzyme inhibitors - reversible, irreversible, Kcat inhibitors; d) Transition state analogs, enzyme inhibitors as drugs - ACE, cyclooxygenase, DNA polymerase inhibitors, HIV -protease/reverse transcriptase and cytochrome P-450 inhibitors; e) Basic idea about the drug binding to nucleic acid: antimalarial & anti-cancer drugs.

Reference Books:

1. Medicinal chemistry (Vol. I and II)-Burger.
2. The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
3. Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
4. Medicinal Chemistry- Ashutosh Kar
5. Medicinal Chemistry- Balkishen Razdan
6. V. K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Anes Student Edition, 2008
7. S. K. Gupta, Drug screening methods, New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2004.
8. Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 1995.
9. A. Gringuage, Introduction to Medicinal Chemistry, Wiley-VCH, 1997.
10. E. Stevens, Medicinal Chemistry-The Modern Drug Discovery Process, Pearson, 2014.
11. R.S. Satoskar, S. D. Bhandarkar, Pharmacology and Pharmacotherapeutics, Popular Prakeshan, 21st edn., 2009.

CHED-420(A): Pharmaceutical & Industrial Practices

04 Hrs/Week

Credits: 04

Marks 100

Section A

Unit I: Various departments in a Pharmaceutical Industry

20 Hrs

Information about each section-their organization, work carried out, monitoring, interactions with various departments.

Overall idea of each department: Drug discovery, Process development, Pharmaceutical formulation, Production (Bulk drugs & Fine chemicals), Analysis (Intermediates, Finished goods & formulations)

Unit II: Intellectual Property Rights and Regulatory affairs

10 Hrs

Product protection, Patenting, Regulated-non regulated markets, Packaging: (Designing & Stability), Distribution: (Local & Overseas), Selling: (Local & Overseas), Advertising: (Local & Overseas), Waste disposal: An environment protection

Section B : Entrepreneurship Development

Unit III : Fundamentals of Entrepreneurship Development

8 Hrs

Concept and need of Entrepreneurship, Development and Definition of Entrepreneurship, Entrepreneurship, Innovation, Invention, Creativity, Business, Idea, Opportunities, through change, Concept of Entrepreneurship, Manager, Entrepreneur/ cooperate, Entrepreneur-comparative study-Roles, Responsibilities, Career opportunity, Entrepreneurship as a carrier, Entrepreneurship as style of management, The changing role of Entrepreneur: mid career dilemmas, -Closing the window; Sustaining competitive-Maintaining competitive advantages.

Unit IV: Theory of Entrepreneurship

8 Hrs

- a. Innovation Theory by Schumpeter & Imitating
- b. Theory of High Achievement by McClelland
- c. X-Efficiency Theory by Leibenstein
- d. Theory of profit by Knight
- e. Theory of Social change by Everett Hagen

Unit V : Influence of Entrepreneurship development

8 Hrs

a. Entrepreneur Traits, b. External influence on Entrepreneurship Development: Socio-cultural, political, Economical, Personal, Entrepreneurial culture with special reference to Entrepreneurship, Corporate Entrepreneurship c. Entrepreneurial Success and failure: Reasons and Remedies

Unit VI : Business planning process

6 Hrs

The business plan as Entrepreneurial tool, Element of Business plan, Objectives, market Analysis, Development of product /idea, Marketing Finance, Organization & Management, Ownership, Critical risk, contingencies of the proposal, Scheduling and Milestones.

Reference books

1. Medicinal chemistry (Vol. I and II)-Burger.
2. The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
3. Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
4. Medicinal chemistry-William O. Foye
5. Entrepreneurship –Robert D Hisrich, Michael P, Peters, Dean A Shepherd
6. Entrepreneurship as strategy –G, Dale Meyer,kurt A. Heppard
7. Project Manegment: K. Nagarajan
8. The Culture of Entrepreneurship-Brigitte Berger
9. Entrepreneurship: New venture Creation –David H Holt
10. T. B. of Organic medicinal and pharmaceutical chemistry-Wilson and Gisvold's (Ed. Robert F. Dorge)
11. An introduction to medicinal chemistry-Graham L. Patrick.
12. An introduction to drug design-S. S. Pandeya and J. R. Dimmock (New age international)
13. Pharmacological basis of therapeutics-Goodman and Gilman's (McGraw Hill)
14. Manual of patent practice and procedure-Patent office, India (2005)

CHED-420 (B) : Bio-organic & Green chemistry

04 Hrs/Week

Credits: 04

Marks 100

Unit I: Enzyme

4 Hrs

Introduction, Active sites, Mechanism of enzyme action, Inhibition, Isolation and purification of enzyme, enzyme kinetics, co-enzyme, enzyme models, chemical use of enzymes, Therapeutic application of enzymes, recombinant DNA technology

Unit II: Carbohydrates

10Hrs

Conformation of monosaccharides; structures and function of important derivatives of monosaccharides like Glycosides, Deoxy sugars, Myoinositol, amino sugars, N-aceylmuranic acid and sialic acid, disaccharides and polysaccharides. Structural polysaccharides: Cellulose and Chitin. Storage polysaccharides: Starch and Glycogen. Structure and biological function of Glucosaminogycans or mucopolusaccharides. Carbohydrates of glycoproteins and glycolinides. Role of sugars in bio;logical recognition. Blood group substances, Ascorbic acid. Carbohydrate metabolism: Kreb's cycle, Glycolysis, Glyvogenolusis, Gluconeogenesis and Pentose phosphate pathways.

Unit III: Lipids

6 Hrs

Fatty acids, essential fatty acids, structures and function of triglycerides, glyceropholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Lipoproteins and function, role in antherosclerosis. Properties of lipid aggregates-Micelles, Bilayers, liposomes and their possible biological functions. Biological membranes, Fluid mosaic model membrane structure. Lipid metabolism: Beta oxidation of fatty acids

Unit IV: Amino acids, Peptides and Proteins

10 Hrs

Chemical and enzymatic hydrolysis of prteins to peptides, amino acid sequencing. Secondary structure of protein, forces responsible for holding of secondary structure a helix, beta-sheets, super secondary structure, triple helix structure of collagen.

Unit V: Nucleic Acids

10 Hrs

Purine and pyrimidine bases of nucleic acids, base pairing via H-bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible or Holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an Overview of replication of DNA, Transcription, translation and genetic code. Chemical synthesis of mono and dinucleosides.

Unit VI: Green Chemistry

10 Hrs

Introduction, Ideal synthesis, theoretical and functional details of following eco-friendly synthetic protocols with suitable examples ad applications.

- a) Neat synthesis (solvent free synthesis)
- b) Non-volatile organic media and water as green media in organic transformations like ionic liquid, PEG and water.
- c) Microwave irradiation as alternative energy source for the chemical transformations.
- d) Heterogeneous catalysis / Immobile catalysis.
- e) Ultrasound assisted synthesis.

Reference Books:

1. Bioorganic chemistry By Hermann Dugas.
2. Biotransformation in organic chemistry By K. Faber.
3. Enzyme structure and Mechanism By Alan Faber
4. Enzyme Catalysis in organic synthesis Vol. 1 By Karlheinz Drauz and Herbert Waldmann.
5. Bioorganic, Bioinorganic and Supramolecular chemistry By P. S. Kalsi and J. P. Kalsi.
6. Organic Chemistry IV Edn G.Marc Loudon.
7. Green Chemistry By Paul T. Anastas and John C. Warner
8. Green Chemistry By Rashmi Sanghi and M. M. Srivastav

CHED-420 (C) : Drug Design & Drug Discovery

04 Hrs/Week

Credits: 04

Marks 100

UNIT-I: Principles of Drug design and drug discovery

[12 hrs]

Introduction to drug discovery, Folklore drugs, stages involved in drug discovery- disease, drug targets, bioassay. Discovery of a lead, screening of natural products and synthetic compound libraries. Pharmacokinetics (ADME), pharmacodynamics, Nature of drug-receptor interactions and their theories-Occupancy theory, Induced-fit theory, Macromolecular perturbation theory and Two-state model of receptor activation. Natural products as lead structures in drug discovery, Pharmacophore, structure pruning technique e.g. morphine. Discovery of lead structure from natural hormones and neurotransmitters, Principles of design of agonists (e.g. Salbutamol), antagonists (e.g. cimitidine) and enzyme inhibitors (e.g. captopril), Drug discovery without lead, serendipity, Penicillin and Librium as examples, Principles of prodrug design.

UNIT-II: Lead modification and SAR Studies

[12 hrs]

SAR: Lead modification strategies, Bioisosterism, variation of alkyl substituents, chain homologation and branching, variation of aromatic substituents, extension of structure, ring expansion and ring contraction, ring variation, variation and position of hetero atoms, ring fusion, simplification of the lead, rigidification of lead. Discovery of oxamiquine, salbutamol, cimitidine and captopril SAR studies in sulfa drugs, benzodiazepines, and taxol analogs.

UNIT-III: Quantitative Structure-Activity Relationship (QSAR) studies

[12 hrs]

Introduction, physicochemical properties - pKa, electronic effects and Hammett constants (σ), lipophilicity constant (π), steric effects and Taft's constant, linear and nonlinear relationship between biological activity and Hammett/ Lipophilicity Substituent constants. Lipinski rule of five. Hansch analysis, Craig's plot, Topliss scheme, Free Wilson approach, cluster significant analysis. Principles of molecular modeling in drug design.

UNIT-IV: Combinatorial Synthesis

[12 hrs]

Introduction, Combinatorial approach, Combinatorial libraries, technologies. Solid phase synthesis, types of resins, Linkers, Reactants for solid phased synthesis, Methods of Parallel synthesis: Haughton's tea bag procedure, Automated parallel synthesis. Methods in Mixed combinatorial synthesis: general principles. Furkasmix and split combinatorial synthesis, Structure determination of active compounds, Deconvolution, Methods in deconvolution-recursive deconvolution, tagging and use of decoded sheets. Examples of Combinatorial

Chemistry, Planning and designing of combinatorial synthesis, Spider like scaffolds, drug molecules, Automation in Combinatorial chemistry, High throughput screening.

Reference books

1. Burger's medicinal chemistry and drug discovery by Manfred E. Wolf.
2. Introduction to Medicinal chemistry by Patrick.
3. Introduction to drug design by R Silverman
4. Comprehensive medicinal chemistry. Vol 1-5 by Hanzsch.
5. Principles of medicinal chemistry. by William Foye
6. Biochemical approach to medicinal chemistry by Thomas Nogrady.
7. Pharmaceutical Chemistry and Drug synthesis by Roth and Kleeman
8. Drug design by E.J.Arienes
9. Principles of Medicinal Chemistry Vol I & II by Kadam et al
10. Medicinal chemistry An introduction by Garreth Thomas
11. Organic and Pharmaceutical chemistry By Delgrado
12. Organic Pharmaceutical chemistry By Harikishan singh
13. Medicinal Chemistry By Ashtoshkar
14. Medicinal Chemistry By Chatwal
15. Organic Drug synthesis By Ledneicer Vol 1-6
16. Strategies for organic drug synthesis and design By Daniel Ledneicer.
17. Top Drugs: Top synthetic routes By John Saunders
18. Burger's Medicinal Chemistry and Drug Discovery: Principles and Practices. Vol. 1.
19. Medicinal Chemistry by G. Patricks.
20. Text book of Drug Design and Discovery, Edited by Povl Krosgaard – Larsen Tommy Liljefors.

CHED-421: Laboratory course

4.5 Hrs/Week

Credits: 4.5

Marks : 50

Drug Synthesis.

Drug synthesis laboratory course involve synthesis of intermediates and drug molecules.

CHED-422: Laboratory course

4.5 Hrs/Week

Credits: 4.5

Marks : 50

Drug Assay.

Drug assay laboratory course involve isolation of important organic compounds from natural sources and assay of some drugs.

CHED-423: Laboratory course

4.5 Hrs/Week

Credits: 4.5

Marks : 50

(A) Research project (Experimental)

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

CHED-424: Laboratory course

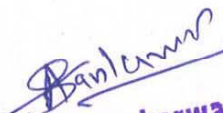
4.5 Hrs/week

Credit : 4.5

50 Marks

Research project : Dissertation, Presentation and Seminars

Dissertation be prepared and should contains literature survey aim scope of the project experimental details and results and discussion.


(Dr. Anil G. Shankarwar)
Chairman BOS Chemistry
Dr. Babasaheb Ambedkar Marathwada University
Aurangabad.
