

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2022
'B++' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Chemistry (GE)

Name of the Course: B.Sc. I Sem. I & II (Liberal Science)

(Syllabus to be implemented from June 2022)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science)

Semester-I

Paper I : Fundamentals of Medicinal Chemistry

Scope: This subject is designed to impart fundamental knowledge on the medicinal uses of inorganic chemical substances used as drugs and pharmaceuticals. Also, this course discusses the impurities, quality control aspects of chemical substances used in pharmaceuticals. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs.

Objectives: Upon completion of course student shall be able to

1. Understand the metabolism principles of drug.
2. Understand the relationship between chemical structure and activity.
3. Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
4. Understand the medicinal and pharmaceutical importance of inorganic compounds

UNIT- I

(15 Hours)

- A) Introduction to Medicinal Chemistry
- B) History and development of medicinal chemistry
- C) Physicochemical properties in relation to biological action, Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.
- D) Drug metabolism
Drug metabolism principles - Phase I and Phase II. Factors affecting drug metabolism.
- E) Introduction to Structural Activity Relationship - Factors effecting bioactivity, resonance, inductive effect, isosterism, bioisosterism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, rate theory, induced-fit theory.

UNIT II

(15 Hours)

- A) **Impurities in pharmaceutical substances:** Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.
- B) **Fundamentals of volumetric analysis:** Acid-base titration, non-aqueous titration, precipitation titration, complexometric titration, redox titration.

C) **Inorganic Pharmaceuticals:** Pharmaceutical formulations, market preparations, storage conditions and uses of • **Haematinics:** Ferrous sulphate, Ferrous fumarate, Ferric ammonium citrate, Ferrous ascorbate, Carbonyl iron • **Antacids:** Aluminium hydroxide gel, Magnesium hydroxide, Magaldrate, Sodium bicarbonate, Calcium Carbonate • **Anti-microbial agents:** Silver Nitrate, Ionic Silver, Chlorhexidine Gluconate, Hydrogen peroxide, Boric acid, Potassium permanganate • **Dental products:** Calcium carbonate, Sodium fluoride, Mouth washes.

Practical's:

- A) **Limit test:** Chlorides, Sulphates, Iron, Heavy metals, Lead, Arsenic.
- B) **Identification test:** Sodium bicarbonate, Magnesium Sulphate, Ferrous sulphate, Sodium Chloride, Boric Acid, Sodium Acetate.
- C) **Assay of:** Ferrous sulphate, Calcium gluconate, Boric acid, Sodium Bicarbonate, Hydrogen peroxide, Sodium Chloride (Mohrs Method)

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Indian Pharmacopoeia.



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B. Sc. First Year (Liberal Science)

Semester-I

Paper II: Bioorganic and Pharmaceutical Chemistry

Scope: This course is designed to impart basic knowledge on the study of structure and functions of biomolecules and the chemical processes associated with living cells in normal and abnormal states. This course also emphasizes on heterocyclic compounds and important class of drugs.

Objectives: Upon completion of course student shall be able to

1. Understand Structure and Functions of biomolecules
2. Identify the Qualitative and quantitative determination of biomolecules / metabolites in the sample.
3. Write the chemical synthesis of important heterocycles as well as important drugs of common category.

UNIT I

(15 Hours)

- A) **Drug Classification and Sources of drugs:** Sources and uses of Natural drug products – Biological (plants, animals and microbes), Geographical, Marine and Mineral Sources.
- B) **Drug Absorption:** Route of Drug Administration. Mechanism of Absorption of Drugs and factors affecting Absorption.
- C) **Physiology of Biomolecular:** Classification, General structure and Physiological Functions of Carbohydrates, Lipids and Proteins. Digestion and biological oxidation of Carbohydrates, Fats, Proteins.
- D) **Chemistry of Nucleic Acids:** Constituents of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only) Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation

UNIT – II

(15 Hours)

- A) Heterocyclic compounds:** Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives- Pyrrole, Furan, Thiophene, Pyrazole, Oxazole.
- B) Synthesis of the representative drugs of the following classes:** Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphamethoxazol, Sulphacetamide); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular agents (Glyceryl trinitrate), HIV-AIDS related drugs (AZT- Zidovudin)

Practicals :

1. Synthesis of heterocyclic nuclei such as Pyrazole, Oxazole, Imidazole, Thiazole, Indole, Benzimidazole, Phenothiazines.
2. Qualitative analysis of carbohydrates (3 experiments)
3. Qualitative analysis of Proteins and amino acids (3 experiments)
4. Qualitative analysis of lipids (2 experiments)

Recommended Books (Latest Editions)

1. Essentials of Biochemistry by U. Satyanarayana, Books and Allied (P) Ltd.
2. Practical Biochemistry by R.C. Gupta and S. Bhargava.
3. Laboratory manual of Biochemistry by Pattabiraman and Sitaram Acharya
4. Tool of Biochemistry, Cooper, T.G. Wiley-Blackwell (1977). 8. Wilson, K. & Walker, J. Practical Biochemistry. Cambridge University Press (2009)
5. Burger's Medicinal Chemistry, Vol I to IV.
6. Pharmaceutical Chemistry-I Inorganic, GR Chatwal, Himalaya Publishing House, Latest edition.
7. Pharmaceutical Inorganic Chemistry, K. S. Jain, Dr P. B. Miniyar, Dr K Ilango, 2nd edition, 2018, Nirali prakasha
8. Morrison R.T. and Boyd R.N., Bhattacharjee S.K. Organic Chemistry, 7 th Edition, Dorling Kindersley(India) Pvt. Ltd. (Pearson Education).
9. Finar I.L., Organic Chemistry, 6 th Edition, Vol.-I, Dorling Kindersley (India) Pvt. Ltd (Pearson Education).
10. Acheson R.M., An Introduction to the Chemistry of Heterocyclic Compounds, 3 rd Edition, Wiley(India) Pvt. Ltd.
11. Gilchrist T.L., Heterocyclic Chemistry, Pearson Education (Singapore) Ltd.

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Name of the Faculty: Science & Technology

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Syllabus: Chemistry

Name of the Course: B.Sc. I Sem. II (Liberal Science)

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B. Sc. First Year (Liberal Science)

Semester-II

Paper III : Medicinal Chemistry- I

Scope: This course is designed to impart basic knowledge on the study of structure and Activity relationship with structure of drugs belong to class Hypnotics and Sedative, Analgesics and Antipyretic. This course also includes practical work of synthesis and determination of some important physiochemical parameters of drug molecule.

Objectives: Upon completion of course student shall be able to

1. Understand Structural activity relationship of important drugs belong to class Analgesics and Antipyretic.
2. Carry out the synthesis of important drugs belonging to class Analgesics and Antipyretic.
3. Understand the importance of Analgesics and Antipyretic in medical science.

Unit – I (15 Hrs)

- A. General anesthetics:** Classification, mechanism of action, synthesis of Nitrous oxide, halothane, thiopental sodium and chloroform.
- B. Local anesthetics:** Classification, mechanism of action, SAR of procaine hydrochloride, benzocaine, lignocaine hydrochloride.
- C. Diuretics:** Classification. Mechanism of action and SAR and uses of hydrochlorthiazide, acetazolamide.

Unit- II (15 Hrs)

- A. Analgesics and antipyretics:** Classification, mechanism of action and SAR of morphine analogue. Mechanism of action and SAR of salicylic acid, aryl alcanoic acid derivatives, synthesis of aspirin and paracetamol.
- B. Anti-histaminics:** Classification, mechanism of action and SAR ethanolamine derivatives synthesis of diphenhydramine hydrochloride, promethazine hydrochloride.

Practicals

1. Synthesis of Aspirine, Paracetamol.
2. Determination of partition coefficient of any three drugs.
3. Determination of iodine value, acid value and saponification value.
4. Separation of amino acids by paper chromatography.

Books recommended.

1. Wilson and Gisvold's Text Book of Organic and Medicinal Chemistry
2. Medicinal Chemistry by Sriram, and Yogecewari
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Pharmaceutical Chemistry-I Inorganic, GR Chatwal, Himalaya Publishing House, Latest edition.
5. Pharmaceutical Inorganic Chemistry, K. S. Jain, Dr P. B. Miniyar, Dr K Ilango, 2nd edition, 2018, Nirali prakashan.
6. Morrison R.T. and Boyd R.N., Bhattacharjee S.K. Organic Chemistry, 7 th Edition, Dorling Kindersley(India) Pvt. Ltd. (Pearson Education).
7. Finar I.L., Organic Chemistry, 6 th Edition, Vol.-I, Dorling Kindersley (India) Pvt. Ltd (Pearson Education).
8. Acheson R.M., An Introduction to the Chemistry of Heterocyclic Compounds, 3 rd Edition, Wiley(India) Pvt. Ltd.
9. Gilchrist T.L., Heterocyclic Chemistry, Pearson Education (Singapore) Ltd.
10. Indian Pharmacopoeia latest edition.

Paper IV : Medicinal Chemistry- II

Scope: This course is designed to impart basic knowledge on the study of structure and Activity relationship with structure of Antibiotics, Antiviral and Antimalarial and Anti-TB drugs. This course also emphasizes on synthesis and determination of purity of important drug molecule.

Objectives: Upon completion of course student shall be able to

1. Understand Structural activity relationship of important drugs belong to class Antibiotics, Antimalarial and Anti-Tuberculosis.
2. Carry out the synthesis of and purity determination of important drugs belonging to Antibiotics, Antimalarial and Anti-Tuberculosis.
3. Understand the importance and use of Antibiotics, Antiviral and Antimalarial and Anti-Tuberculosis.

Unit I (15 Hrs)

- A. Antibiotics:** Historical background, Structure activity relationship. Chemical Classification of β -lactum antibiotics: Penicillin, Cephalosporin.
- B. Aminoglycosides:** Streptomycin and neomycin, **Tetracyclines:** Tetracycline,
- C. Macrolide:** Azithromycin. Synthesis and uses of chloramphenicol.
- D. Sulphonamide:** Classification and mechanism of action, synthesis and uses of sulphacetamide, sulphaguianide, dapsone.

Unit II (15 Hrs)

- A. Anti-malarial:** Classification, mechanism of action, SAR of 4-amino quinolines. Synthesis of chloroquine phosphate, amodiaquine hydrochloride, primaquine phosphate.
- B. Anti-tubercular drugs:** Classification. Mechanism, synthesis and uses of para-amino salicylic acid, isoniazid, rifampicin.

Practical

1. Synthesis of any 4 drug molecule from category Antibiotics/Anti-TB/Antimalarial.
2. Assay of any 4 drug molecule from category Antibiotics/Anti-TB/Antimalarial.
3. Separation and identification of organic binary mixture.

Books recommended.

1. Wilson and Gisvold's Text Book of Organic and Medicinal Chemistry
2. Medicinal Chemistry by Sriram, and Yogeeswari
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Pharmaceutical Chemistry-I Inorganic, GR Chatwal, Himalaya Publishing House, Latest edition.
5. Pharmaceutical Inorganic Chemistry, K. S. Jain, Dr P. B. Miniyar, Dr K Ilango, 2nd edition, 2018, Nirali prakashan.
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