

**Republic of Yemen
Thamar University**

Faculty of Medicine and Health Sciences

**Syllabus of
Bachelor of Pharmacy
Degree**

2005



Syllabus committee

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First Year

1) General Chemistry

Objectives:

This course aims to present the highlights of chemistry and its applications in a brief and suitable manner with relevancy to pharmacy.

A) Theoretical Part:

1. Measurements and their Units Length, Volume, Mass, Density, Temperature, Energy, Concentration.

2. Atomic Structure and the Periodic Table:

Atomic spectra, Electric nature of atom, Electron configuration, Periodic table, Properties related to the periodic table, Atomic radius, Electronegativity, ionization energy, Atomic weight, Atomic number.

3. Bonding and molecular structure:

Types of bonds :ionic bond, covalent bond, co-ordinate bond, hydrogen bond, Polar bonds, Polar molecules, Double and triple bonds, Sigma (σ) and Pi(π) bonds, Intermolecular forces of attraction.

4. Matter and its Properties:

Definition of matter: States of matter, Composition of matter, Properties of matter, Law of Conservation of matter, Law of definite proportions, Law of multiple proportions Chemical formulas (empirical formula, molecular formula).

5. Energy and Conservation of Energy:

Definition of energy, Forms of energy, Law of conservation of energy.

6. Stoichiometry and Chemical Calculations:

Balanced equations, Calculations based on Chemical equations, The mole, Avogadro's number, Equivalent weight, Theoretical Yield and percentage Yield, Percentage Composition, Concentrations of solutions, Percentage concentration (% w/w; %w/v; %V/V), Molar concentration, Formal Concentration, Normal concentration, Preparing dilute solutions from concentrated Solutions.

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7. Acids and Bases:

Definition of acids and bases (Arrhenius theory, Bronsted-Lowry theory, Lewis theory), Factors influencing the strengths of acids, Acid-Base equilibria in aqueous solution, ionization of Water, PH, Dissociation of Weak electrolytes, Dissociation of polyprotic acids, Buffers, Acid-Base titration: the Equivalent point (Strong acid, strong base titration, Acid-base indicators).

B- The kinetic Bases of Chemical Reactions:

The significance of Kinetics, the rates of chemical reactions, The order of a reaction, The rate constant, Reversible and irreversible reactions, Classification of Kinetic reaction, Molecular and order of reaction, Irreversible reaction, First Order, Irreversible reaction, Second Order, Complex chemical reaction, The Order Determination Methods of Chemical Reactions, Chemical equilibrium (The law of Mass Action, Kinetics and Equilibrium, Le Chatelier's principle and Chemical equilibrium, effect of changing the concentration on equilibrium, effect of temperature on equilibrium, effect of pressure on equilibrium, effect of catalyst on the position of equilibrium). Activation energy, The Arrhenius equation: relating temperature and reaction rate.

9. Gases:

Volume and pressure, Boyle's law, Charles's law, Law of Gay-Lussac, Ideal gas Law, Combined gas law, Avogadro's law (the mole concept), Real gases.

10. Liquids, Solids and Phase Changes:

Liquids (Volume and shape, Compression and expansion, Diffusion, Surface tension, Kinetics of liquids), Heat of Vaporization and heat of fusion, Raoult's law and vapor pressure, Boiling point and melting point, Solids (Phase diagram, Phase equilibrium).

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11. Properties of Solutions

Water as a solvent Types of solutions and the concentration units, Heats of solution, Solubility and temperature, Effect of pressure on solubility, Vapor pressures of solutions, Osmosis and osmotic pressure, Dialysis and the blood Stream, Interionic attractions).

12. Chemical Thermodynamics:

Some commonly used terms in thermodynamics (System, Homogeneous system, Heterogeneous system, Phase. Isolated system, Thermodynamic function, Reversible and irreversible processes, Isothermal process, Isochoric process, Isobaric process, Exothermic process, Endothermic Process), The first law of thermodynamics, Enthalpy (Heats of reaction, Hess's law of heat summation, Standard states, Bond energies, Spontaneity of Chemical reactions) Entropy, The second law of thermodynamics, Standard Entropies and free energies).

13. Oxidation and Reduction:

Oxidation reduction reactions, Balancing oxidation-reduction reactions (using the oxidation number method, the ion-electron method), Oxidation - reduction potential, Equivalent of substance in oxidation - reduction reactions.

14. Complex Compounds:

Definition of a complex compound, Complex ion (Central atom, Ligand, Chelate). Coordination number, bonding in complex compounds, Reactions of complex compounds, The dissociation constant of complex ion, Application of complex compounds (water treatment, dyes, chemical analysis, Plant growth, Therapeutic chelating agents), Complex Compounds in living systems.

15. The Bases of Theoretical Organic Chemistry:

Introduction, Classification of organic compounds, Functional groups and their nomenclature, Hybridization of atomic orbital's of carbon atom
 $\text{CH}_3 - \text{CH}_3$ $\text{CH}_2 = \text{CH}_2$ $\text{CH} = \text{CH}$
- SP^3 - SP^2 - SP Chemical reactions in
Organic chemistry general aspects, reaction mechanism, classification of reactions, classification of reagents (Nucleophiles, Electrophiles, Free radical)1, Charge distribution in organic molecules, Inductive effect (Inductive polarization), Mesmeric effect (mesmeric polarization) and PI

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electron delocalization, Energy changes during reactions (Bond dissociation energy, Heat of reaction, Activation energy, Transition state, Progress of reaction), Acidity and basicity of organic compounds (general concepts, measurement of acidity and basicity, acidity of carboxylic acids and phenols, effect of substituent's on acidity, basicity of aliphatic and aromatic amines, effect of substituent's on basicity, basicity of amides, Imides, sulphonamides, amides and guanidine's). Nucleophilic substitution and elimination reactions Physical properties of alkyl halides, Bimolecular and unimolecular reactions (SN 2 and SN 1), Elimination reactions (E 1 and E 2), Factors affecting substitution and elimination reactions (Structure, Leaving group, Nucleophile, Solvent). Selected examples of reactions, Addition elimination reactions of carbonyl compounds (introduction, reactivity of aldehydes, Ketones and carboxylic acid derivatives, factors influencing the rate of nucleophilic addition to carbonyls, addition of H₂O. CH₃ CH₂ OH, cyanide and acetylide, Grignard reagents, hydrides. Addition to - C=N, Enolate anions and enols, Condensation reactions), Electrophilic addition reactions (electrophilic addition of HCL, H₂O and Br₂, free radical addition, polymerisation, cycloaddition), Aromatic substitution reactions aromaticity, mechanism of electrophilic substitution, halogenation, nitration, sulphonation, Friedel-Crafts alkylation and acylation, Substituent effects in aromatic chemistry (Reactivity and orientation, Nucleophilic aromatic substitution), Chemistry of Amines (formation of amines, nucleophilic substitution, amides, Imines and Gabriel synthesis, diazonium ions as electrophiles, azo compounds, Hoffmann elimination, Quaternary ammonium compounds), Chemistry of amino acids, peptides and proteins, Chemistry of carbohydrates, Chemistry of lipids, Chemistry of nucleic acids.

16. Isotopes and Radioactivity:

Nature of Atoms, Isotopes and Radioisotopes, Types of Radioactive Decay (Decay by negative, beta (electron) emission, Decay by positive, beta (positron) emission, Decay by electron capture, Decay by gamma-radiation, Decay by alpha-particle emission), properties of Radioactive Emissions (Energy of particle Emissions, Interaction of particles with their environment, Gamma radiation and its interaction with matter), kinetics of Radioactive Decay (The radioactive process, The rate of radioactive process, The radioactive decay law, The half-life equation of radioisotope), Units Used in Radioactive Measurements (The electron

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volt, The Curie:the unit of radioactive disintegration). Applications in the Use of radioisotopes, The Quantitative Determination of Compounds by Use of Radioisotopes.

B) Practical Part:

Identification of simple organic compounds and volumetric analysis.

II) GENERAL PHYSICS:

A) Theoretical Part:

Linear and circular motion, Force, Work and energy, Conservation of energy, Momentum and angular momentum Elasticity, Pressure of fluids, Surface tension, Bernoulli's equation, Laminar and turbulent flow of fluid, Poiseuille's law Temperature and heat energy, Heat transfer, Radiation, Conduction, Specific heat, First law of thermodynamics and its applications, Diffusion and osmosis.

Wave motion and sound, Intensity level, Decibel, The ear and hearing, Loudness contours, Ultrasonic waves Electric field and potential, Capacitance, Membrane potentials and nerve impulse, Electric current and power, Electrolysis, Effects of electric current in the human body, Magnetic field, Electromagnetic blood flow meter, Electrocardiography, Pacemaker, Electromagnetic induction, Inductance, D/C and A/C circuits. Electromagnetic radiation and spectrum, Wave propagation of light, color and spectra, Lenses and mirrors and their aberrations. The eye and defects of vision, Interference and diffraction of light, Resolving power, Visual acuity, Optical and electron microscopes. Applications on various topics in biosciences.

B) Practical Part:

Selected experiments on the above topics.

III) BIOLOGY (ZOOLOGY):

A) Theoretical Part:

Microbiology new :

1. The chemistry of life:

* Introduction.

* Major groups of organic compounds important in organisms including: Carbohydrates, lipids and nucleic acids (DNA & RNA) many biological molecules are polymers. Carbohydrates, lipids, proteins DNA & RNA.

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2. Organization of the cell:

- * The cell is the basic unit of life
- * Cell size.
- * Light microscope and EM.
- * Prokaryotic and Eukaryotic.
- * The cell nucleus.
- * Ribosome Manufacture Proteins.
- * The endoplasmic Reticulum.
- * Lysosomes.
- * Peroxisomes.
- * Vacuoles.
- * Mitochondria and chloroplasts.

3. Biological membranes:

- * Biological membrane is lipid bilayer with associated proteins.
- * Selective permeable.
- * Cocytois and ordocytosis.
- * Junctions.

4. Energy transfer through living system:

- * Metabolic reactions involve energy transformations.
- * ATP is the energy currency of the cell.
- * Cell transfer energy by Redox reactions.
- * Enzyme are chemical regulators.

5. Energy - Releasing pathways and photosynthesis :

- * Respiration.
- * Photosynthesis.

6. The continuity of life genetics:

- * Chromosomes.
- * Mitosis and Meiosis.
- * Cell cycle.

7. DNA: The carrier of genetic information.

- * Evidence that DNA is the hereditary material.
- * DNA replication.
- * DNA in chromosomes.

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8. RNA and protein synthesis.

*The expression of genetic information.

9. Gene Regulation: The control of Gene expression.

* Gene regulation in prokaryotes.

*Gene regulation in Eukaryotes.

10. Genetic Engineering.

*Recombinant DNA

* Application of Genetic engineering.

11. Genes and developments

* Cellular Differentiation usually does not involve changes in DNA.

* Atotipotent nucleus contain all the information required to direct normal development.

* Most differences among cells are due to differential gene expression

*Mammalian cloning.

B) Practical Part:

Dissecting kit, Technical drawing, the use of the microscope The study of cell components: Tissues: epithelial, connective, muscular, nervous tissues. Major animal phyla :protozoa, amoeba, euglena, paramecium, plasmodium. Coelenterata :hydra, obelia, medusa, Platyhelminthes :faciola hepatica, taeniasoleum and taeniasaginata Eschelminthes:ascaris, lumbricoides, Annelides:the earthworm, Mallusca:the fresh water snail, the oyster, Crustacea :the shrimp, Insecta:the cockroach or the mosquito (colex and anopheles), Chordates:amphloxis, the frog or the rabbit (general dissection), Osteology of the rabbit.

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IV) BIOSTATISTICS :

Objectives:

To enable pharmacy students of using scientific methods of collecting, summarizing, presenting and analyzing data.

-To decide specific statistical technique in order to analyze available data.

-To draw valid conclusion of specific health problem.

-To make reasonable decision on the basis of health analysis.

1. Selected definitions: Statistics, population, sampling, variables, graphs, functions, discrete and continuous distribution, data, etc...

2. Frequency distribution (F.D.) :Definitions, methods of computing F.D. relative F.D. cumulative F.D, double F.D.

3. Average and other measures of central tendency :The averages, arithmetic mean, weighted arithmetic mean, arithmetic mean for grouped and ungrouped data, mode, median, geometric mean, harmonic mean, quadratic mean.

4. Standard deviation and other measures of dispersion:The dispersion, the range, mean deviation, the variance, coefficient of variation.

5. Vital statistics :Introduction, birth measures, crude birth rate, fertility rate, fecundity rate, death measures, crude death rate, sex-specified death rate, age-specified death rate, infant mortality rate, life table.

6. Regression and correlation :Simple and multiple regression, simple and multiple correlation, methods of estimation, rank correlation coefficient.

7. Testing hypothesis:Introduction, level of significance, statistical hypothesis, testing hypothesis.

8. Selected tests :F-test, T-test, CHI-SQUARE test, test of independence, CONTINGENCY coefficient and other tests.

9. Elements of sampling :Introduction, selected definitions, selection of random sample, sampling with and without replacement, estimation of sample size, stratified random sample, random cluster sample, two-stage sample, two-phase sample.

10. Probability theory:General principle, events and sample space, probability events, operations events, combinatriol analysis, permutation and combinations, mathematical expectation, Bayes theory.

11. Probability distribution:Discrete probability distribution, BINOMIAL distribution, NEGATIVE BINOMIAL distribution, GEOMETRIC distribution, POISON distribution, continuous probability distribution, NORMAL distribution, UNIFORM distribution, GAMMA distribution, EXPONENTIAL distribution, CHI-SQUARE distribution, BETA.

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V) PSYCHOLOGY AND MEDICAL SOCIOLOGY:

Objectives:

The educational objectives of psychology and medical sociology:

Have knowledge of principles of psychology and medical sociology.

Acquire knowledge of the personality behaviour and psychological health.

Explain of society in relation to health. Understand theories of the social values, social medicine, preventive, and social welfare.

Correlate objectively between psychology, medical sociology and pharmacy.

1. Psychological principles .
2. Personality .
3. Biological Basic of Behaviour.
4. Mental processes: Sensation, Conceit, Emotion .
5. Mental abilities.
6. Motor skills.
7. Motives .
8. Psychological health .
9. Psychotherapy.
10. Behavioural Medicine .
11. The principles of medical sociology.
12. Sociology of medicine .
13. Sociology of hospital .
14. Preventive method .
15. Professional medicine .
16. Psychological and social medicine.
17. Social Welfare, Preventive method, Professional medicine, Psychological and social medicine, Social Welfare.

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Second year

1) PHARMACEUTICAL ORGANIC CHEMISTRY (1):

The General Objectives:

The different branches of chemistry and mainly organic chemistry are the corner stone in understanding other subjects which are majors for students of pharmacy such as pharmaceutical chemistry, pharmaceutics. Pharmacology, biochemistry, pathology... etc. The recent explosive development of molecular biology and genetic engineering makes it Imperative for students of pharmacy and other biological sciences to have a strong background in Organic Chemistry. The naturally occurring organic compounds are of concern to the specialists in biological sciences as well as to the organic chemists, and indeed it is in dealing with such substances that biochemistry, medicinal chemistry, and organic chemistry come together and lose their individual identity. The naturally occurring compounds include the proteins, fats, carbohydrates, vitamins, and hormones that compose living cells, many of the drugs used to control diseases and relieve suffering; the perfumes and colors of the plants world; and thousands of substances that participate in the metabolic activities of living things. With planning this syllabus the following considerations were taken into account:

A) In order to understand biological phenomena at the molecular level, particularly the metabolic pathways by which materials are interconverted in cells, they need to know the reactions of the functional groups which are present in molecules occurring in nature and also the mechanisms of reactions to get the bases of rationalization the industrial and biological processes. Since the nature of the reaction of functional groups depend on the electronic structure of the groups accounts of chemical reactivity are Prefaced by electro negativity of elements which is the base of many organic molecules properties, bonds energies and a survey of chemical bonding in which emphasis is placed on covalent bonding and by an account of some general aspects of chemical reactions.

B) Stereochemistry a topic which is of great importance in any account of biochemical reactions. In our opinion it is important to provide a logical Connection between the laboratory reactions of the Organic Chemistry and its counterpart in a living call.

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C) Also the most important methods of synthesis of simple organic compounds were highlighted in this syllabus to give an idea that there is no limit to the number of organic compounds that can be made, and indeed the known synthetic compounds include many naturally occurring compounds that have been prepared synthetically as final confirmation of their structures.

D) The physical methods used in Organic Chemistry (such as elemental analysis, UVAIS, IR, NMR, MS) were included as they are very important for students of pharmacy to identify and characterize carbon compounds.

E) The heterocyclic compounds were given more considerations as they are representing the most of pharmaceutical compounds with biological significance.

1. Introduction to Organic Compounds:

- Classification of Carbon Compounds :Aliphatic compounds, Salicylic compounds, Aromatic compounds, Heterocyclic compounds.

- The Structures and Nomenclature of Functional Groups.

- Bonding in Organic Compounds: Covalent Bonding, Co-ordinate Bonding, Ionic Bonding in Organic Compounds, and the Hydrogen Bond.

-Structure and Physical Properties of Organic Compounds :Bond Dissociation Energy, Polarity of Bonds, Polarity of Molecules, Melting Points, Intermolecular Forces (Dipole-Dipole Interactions, Hydrogen Bonds, and Van Der Waals Forces), Boiling Point, and Solubility.

- Acids and Bases: The Lowry-Bronsted Definition, and the Lewis Definition

- Hybridization of Atomic Orbitals of Carbon: Carbon Atom in the Ground State and in the Excited State, SP³-Hybridisation, SP²-Hybridisation, SP-Hybridization, the Formation of single, double, and triple Bonds between Carbon Atoms, the Structure of NH₃ and H₂O (SP³-Hybridisation).

2. Isomerism:

Introduction and Definition, Structural Isomerism (Definition, Chain Isomerism, Position, isomerism, Functional Isomerism, Metamerism, Tautomerism), Stereoisomerism or Stereochemistry (Definition, Tetrahedral Carbon Atom, Optical isomerism, Polarized light, Optical activity, Specific optical rotation, Polarimeter, Chirality, Enantiomerism, Racemisation(Definition, Racemic modifications preparation, and

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Resolution of racemic modifications), Diastereomerism, Geometric Isomerism (cis- and trans-isomers), Z/ E Isomerism, Meso Compounds, Relative and Absolute Configurations Definition Relative Configurations D. and L. Absolute Configurations R. and S., Number of Stereoisomers, Representation of Configuration of Enantiomers (Fischer's Projection, Newman's Projection, Wedge Projection, and Sawhorse Projection Formulas), Elements of Symmetry (Plane and Centre of Symmetry), Optical Isomerism without Asymmetric Atom.

3. Conformational isomerism of Alkenes:

Definition, Staggered, Eclipsed, and Gauche Conformers. Factors influencing the Conformational Stability (Torsional Strain, Steric Strain due to Van Der Waals Forces, Dipole-dipole Interaction).

4. Alkanes (Paraffinic Hydrocarbons):

Definition and Nomenclature, Structural Isomerism, Nomenclature of Functional groups, General methods of preparation, Naturally occurring Alkanes, Properties of Alkanes, General Reactivity, Halogenation, Oxidation, Dehydrogenation Nitration, and Sulphonation of Alkanes.

5. Alkenes-Double Bond (Olefins Hydrocarbons):

Definition, Nomenclature, Compounds of Biological interest which contain Double Bonds, General methods of preparation, Properties of Alkenes, General reactivity (Addition of Halogens, Addition of water and related compounds, Oxidation - Reduction of the Double Bond, Addition reactions to the substituted Double Bond and Markovnikov's Rule).

6. Dienes :

Cumulative Dienes (Synthesis and Reactions), Isolated Dienes (Synthesis and Reactions), Conjugated Dienes (Synthesis and Reactions).

7. Alkynes :

Definition and Nomenclature, General methods of preparation, Reactions of Alkynes.

8. Cyclic Aliphatic Hydrocarbons (Cycloalkanes):

definition, Nomenclature, Conformations of Cycloalkanes and their Stabilities, Factors influencing stability of conformation (Angle Strain torsional Strain, Steric Strain, Dipole -dipole interactions), Conformations of Cyclohexane (Chair Conformation, and Boat Conformation), Equatorial and Axial Bonds in Cyclohexane, 1,3-Diaxial interactions in substituted Cyclohexane, Stereoisomerism in Cyclic Compounds (cis. and trans-isomers), Enantiomers in Cyclic Compounds.

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9. Chemical Reactions :

General aspects of Chemical Reactions, Reaction Mechanism, Classification of Organic Reactions (Substitution, Elimination, Addition to Multiple Bonds, Molecular Rearrangements). Classification of Organic Reagents (Nucleophiles, Electrophiles, and Free Radicals), Charge Distribution in Organic Molecules and Electronegativity, Inductive effect, Mesomeric Effect and Electron Delocalisation and Resonance.

10. Energy Changes during Reactions :

Bond Dissociation Energy, Heat of Reaction, Energy of Activation, Transition State, Progress of Reaction (Exothermic and Endothermic Reaction).

11. Aliphatic Nucleophilic Substitution Reactions :

Definition, the Relationship between Nucleophilicity and Basicity, the SN2 Mechanism, the SN1 Mechanism, the Factors Favouring either SN2 or SN1 Reactions, Energetics of SN1 and SN2 Reactions, Stereochemistry of SN1 and SN2 Reactions, Mixed SN1 and SN2 Mechanisms, Transition between SN1 and SN2 Mechanisms, Factors influencing the course of Substitution Reactions (Nature of the substrate, Nature of the Solvent, Nature of the Nucleophile, Nature of the Leaving Group, the Neighbouring Group Participation)

12. Elimination Reactions :

Elimination, - Elimination or 1,2-Elimination (Dehydrogenation, Dehydration, Dehalogenation, and Dehydrohalogenation). Et and E2 Mechanisms, Competition between E2 and SN2 Reactions, E1cB Eliminations, Orientation of Double Bond.

13. Alkylation :

Definition, Perkin's Reaction, Knoevenagel's Reaction, Stobbe's Condensation, Michael's Addition Reaction, Cyanoethylation, Mannich's Reaction, Reformatsky's Reaction.

1. Molecular Rearrangements:

Definition, Pinacol's rearrangement, Wanger-Meerwein's rearrangement, Wolff rearrangement, Hofmann's rearrangement, Lassen's rearrangement, Beckmann's rearrangement, Claassen's rearrangement, Allylic rearrangement, Favorskill's rearrangement, Orton's rearrangement.

5. Free Radical Reactions :

Definition, Generation of Stable Free Radicals, Generation of Short-lived Free Radicals, Radical Coupling Reactions, Types of Free Radical

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Reactions (Radical Displacement, Radical Addition, Radical Substitution in Aromatic Systems).

6. Benzenoids :

Definition, Structure of Benzene and Resonance Theory, Aromatic Character. Nomenclature of Benzene Derivatives, Electrophilic Aromatic Substitution (Electrophilic Substitution reactions mechanism, Halogenation. Nitration, Sulphonation, Friedel-Craft's Alkylation, Friedel-Crafts Acylation), Effect of substituents on disubstitution of Benzene, Effect of substituent on orientation (o-, m-, p-), Effect of Substituent on Reactivity. Theory of Relative Reactivity and Orientation (The Effects of induction effect I, and Mesomeric effect M). Ortho-Para Directing groups with + Effect, Ortho-Para Directing groups having and +M Effects, Meta-Directing groups, Effect of Halogens (Ortho-Para Directing groups but deactivate the Benzene Ring). Ortho Para ratio in the formation of disubstitution derivatives, Introduction of a third substituent into the Benzene Ring, Importance of orientation and reactivity in synthesis, Aliphatic Aromatic Hydrocarbons (Arenes), General methods of preparation of Alkylbenzenes (Friedel-Craft's Alkylation, Friedel-Craft's Acylation followed by reduction. Wurtz-Fitting reaction), Physical properties of Alkylbenzenes, Chemical properties of Alkylbenzenes (Substitution reactions of the Benzene Ring such as Halogenation, Nitration, Sulphonation, Friedel-Crafts Reactions), Substitution reactions of the Alkyl Side Chains such as Halogenation Free Radical Reaction), Hydrogenation, Oxidation, Aromatic Nucleophilic substitution, Factors affecting Nucleophilic Substitution Structure of Substrate, Effect of leaving group. Effect of attacking group).

17. Alkyl Halides :

Definition, Nomenclature (Common and IUPAC Systems), Methods of Preparation, Physical Properties, Chemical Properties (Nucleophilic Substitution Reactions S_N - such as Replacement of Halogen by Hydroxyl Group, Alkoxy Group, Cyano Group, Carboxyl Group, Amino Group, Hydrosulphide Group, Mercaptide Group, Alkyl and Aryl Group, Elimination Reactions (E_1 and E_2 Mechanisms). Reduction of Alkyl Halides Formation of Grignard Reagents, Unsaturated Halogen Compounds such as Vinyl and Aryl Halides and their Low Reactivity, Allylic Halides, Polyhalogen Compounds such as Chloroform, Carbon Tetrachloride, Their Synthesis and Reactions.

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18. Alcohols :

Definitions, Classification, Nomenclature (Common and IUPAC Systems). General methods of preparation, Physical properties and the Hydrogen Bonding, Chemical properties :Reactions involving the cleavage of OH Bond (such as reaction with Metals, Reaction with Grignard reagents, Reactions with Organic Acids, Reactions with Acid Halides or Acid Anhydrides), Reactions involving the cleavage of C-OH Bond (such as reactions with Hydrogen Halides, Reactions with phosphorus halides and reaction with Thionyl Chloride), Reactions involving both Alkyl and Hydroxyl Groups (such as Dehydration, Oxidation of Primary, Secondary, and Tertiary Alcohols).

19. Ethers :

Definitions, Nomenclature (Common and IUPAC Systems), General methods of Preparation, Physical properties, Chemical properties (Formation of Oxonium Salts, Formation of Peroxides, Cleavage by Acids such as HBR and HCl Through SN1 or SN2 Mechanisms, Electrophilic Substitution in Aromatic Ethers).

20. Aldehydes and Ketones :

Structure of Carbonyl group and Definition of Aldehydes and Ketones, Nomenclature of Aldehydes and Ketones (Common and IUPAC Systems), Methods of Aldehydes and Ketones preparation, Physical properties of Aldehydes and Ketones, Chemical properties of Aldehydes and Ketones (Reactivity of Carbonyl group towards Nucleophilic attack, Role of Acidcatalysis in Nucleophilic Reactions. Acidity of Hydrogen's, Nucleophilic addition reactions such as addition of Sodium Bisulphate, Addition of Ammonia derivatives such as NH₂NH₂, NH₂NHC₆H₅, NHANHCONH₂ and semi-carbazide, Addition of Alcohols, Addition of Hydrogen Cyanide, Addition of Grignard reagents, Reformatsky reaction, Aldol condensations, Ease promoted Halogenation, Acid Catalysed Halogenation, Oxidation of Aldehydes and Ketones, Raduction reactions.

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1. Carboxylic Acids:

Definitions and Structure of Carboxyl group. Nomenclature (Common and IUPAC Systems), General methods of preparation, Physical properties and the hydrogen Bonding, Chemical properties (Reactions due to the lonisable Hydrogen such as Acidity and Salt formation, Reactions involving replacement of Hydroxyl group such as Formation of Esters, Formation of Acid Chlorides, formation of Amides, and Formation of Anhydrides, Decarboxylation, Reactions of the Alkyl or Aryl groups, Aromatic Carboxylic Acid Substitution, Acidity Constants of Carboxylic Acids, Effect of Substituents on Acidities of Carboxylic Acids.

2. Amines:

Definition, Classification Nomenclature, General Methods of Preparation, Physical Properties, Chemical Properties (Basicity and Salt Formation, Alkylation, Conversion into Amides, Reaction with Nitrous Acid, Ring Substitution is Aromatic Amines, Basicity of Amines, Effect of Substituents on the Basicity of Aromatic Amines, Exhaustive Methylation of Amines and Hofmann Elimination, Cope Elimination).

Practical Part:

Introduction to practical course in Organic Chemistry.

A- Rules of work in laboratory of Organic Chemistry:

General rules, rules of work with acids and bases, works with explosive, Inflammable, and toxic substances, offering the first aid in cases such as burn, extinguishing of fire and burning clothes in the laboratory.

B-Glassware used in practical Organic Chemistry.

Naming of glassware, cleansing and drying glassware, labeling and storage of samples.

2. The Basic Physical Methods used in Organic Chemistry.

A. Determination of some physical constants :

Melting point, boiling point, refractive index, optical rotation, density, crystallization, sublimation, distillation, extraction

B- Chromatography methods :

gas-adsorption chromatography, high pressure liquid chromatography, thin layer chromatography, column chromatography, paper chromatography.

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II) PHARMACEUTICAL ANALYTICAL CHEMISTRY (1):

A) Theoretical Part:

Qualitative Analysis

1) Anion analysis :Carbonate, bicarbonate and their mixtures, Sulphur salts and mixtures, Halides and mixtures, arsenic, phosphoric acid salts and mixtures, Nitrate and nitrite salts and mixtures, Cyanogen salts and mixtures.

2) Cation analysis :Silver group (single and in unknown mixtures) Copper-Arsenic group (single and in unknown mixtures), Iron group (single and in unknown mixtures), Zinc group (single and in unknown mixtures). Alkaline-earth group (single and in unknown mixtures), Alkali and magnesium group (single and in unknown mixtures). Difficulties in cation

analysis :Insolubles, Phosphate, Organic matter, Oxidizing agent.

3) Complexometric Titrations :General considerations, Titration of metal ions with ligands, Indicators, Applications.

4) Precipitometry:Theory of precipitometry, Titration curves and end point detection, Application.

5) Gravimetry: separations, Colloidal properties, Theory of precipitation process, Purity of precipitates, Organic precipitates, Applications.

III) PHARMACEUTICS (1):

A) Theoretical Part:

1. The prescription :Definition, Parts of prescription, Calculation of the dose, Pharmaceutical Latin, Dispensing of the prescription, Legal aspects in pharmacy, Labeling.

2. Pharmaceutical systems and techniques of measurement :The metric system, the apothecary system, Intersystem conversion, Common household measures, Density and specific gravity, Dilution and concentration.

3. Extraction and extractives :Infusion, decoction, digestion and maceration, Percolation method, Tinctures, liquid extracts and other extractives.

4. Pharmaceutical solution dosage forms: Aqueous solutions, waters, douches, enema, gargles and lotions, Syrups, Coloring and flavoring agents, Non-aqueous solutions.

5. Ophthalmic preparations :Anatomy and physiology of the eye, Ophthalmic solutions :sterility and preservation, isotonicity, buffering,

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viscosity and thickening agents, packaging, Ophthalmic suspensions, Ophthalmic ointments, Ophthalmic inserts.

6. Parenteral solutions: Vehicles and excipients used in the formulation of parenterals, Isotonicity, Sterilization of parenterals, Quality control of parenterals.

7. Surface active agents and solubilization :Interfacial and surface phenomena, Classification of surface active agents, HLB system, Solubilization and its applications.

8. Adsorption phenomena :Adsorption at the solid/liquid interface, Mechanism of adsorption, Adsorption isotherms, Factors affecting adsorption process, Application in pharmacy.

9. Complexation :Definition, Classification, Application and analysis.

10. Reaction Kinetics and drug stability: Rate and order of reactions, Determination of the order of reaction, Factors affecting reaction rate, Accelerated stability testing, Decomposition pathways, Stabilization of medicinal agents.

B) Practical Part:

1. Preparation of aromatic waters :Peppermint water, Chloroform water, Cherry laural water.

2. Preparation of simple syrup.

3. Tutorials for calculations and problems: Metric system, Apothecary system, Interconversions, Dilutions and concentrations.

4. Mixtures, Simple soluble mixture. Mixtures using infusion, Mixtures using decoction, Mixtures containing extracts and tinctures.

5. Tutorials for tonicity and buffer calculations :Different methods of sotonicity calculation, Different methods of different buffers ratio and buffer capacity calculations. .

-Preparation of parenteral solutions.

-Preparation of ophthalmic solutions.

-Measurement of surface tension and CMC.

-Adsorption experiments.

0. Solubilization phase diagram.

1. Hydrolysis of ethyl acetate kinetics in acid medium.

2. Hydrolysis of ethyl acetate kinetics in alkaline medium.

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V) BOTANY AND MEDICINAL PLANTS:

A) Theoretical Part:

1. Plant morphology and anatomy :Seed and seedlings, Cell and cell contents, Morphology of different plant organs, Types of plant tissues, Primary structure of plant organs, Secondary structure in stem and root.

2. Plant kingdom and plant taxonomy :Viruses, Bacteria, Algae, Fungi Bryophytes, Pteridophytea gymnosperms.

An Introduction to plant taxonomy including flower morphology, Terminology and nomenclature, Inflorescences, Fruits, Taxonomic description of some monocot and dicot families with special reference to some medicinal plants.

3. Plant physiology :Colloidal systems, Chemical and physical properties of the protoplasm.

Osmosis :osmotic potential, plant-water relations.

Mineral nutrition.

Enzymes :properties, specificity, classification. Metabolism, anabolism, catabolism, energy metabolism, respiration and photosynthesis. Growth and differentiation.

B) Practical Part:

Selected experiments on the above topics.

V) ANATOMY :

1. Introduction :The organization of the human body, systemic and regional Introduction to the major organ I systems, descriptive terms, terms related to position and movement.

The locomotor system :Components, structure of bone, morphological and gross structural classification of bone, functions of bone, the axial and appendicular skeleton, definition and classification of joints, amphiarthrodial and diarthrodial Joints, types of muscle, morphology of skeletal muscles, major groups of skeletal muscles of head and neck, limbs and trunk. The cardiovascular system: The circulation, the surface markings, interior and blood and nerve supply of the heart, major arteries and their distribution, systemic and portal veins, lymphatic drainage and main groups of lymph nodes.

The respiratory system: The nasal cavity, pharynx, larynx, trachea and bronchi, lungs and pleura.

The digestive system: The mouth cavity, pharynx, oesophagus, stomach, intestines, the associated glands liver and spleen.

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The renal system :The kidneys, ureters, urinary bladder and urethra.
The reproductive system :The male and female gonads, internal duct system and external genitalia.
The neuro-endocrine system :The hypophysis cerebri, thyroid, parathyroid, thymus and adrenal glands, the somatic nervous system; spinal cord and formation of spinal nerve, the brain stem and cerebral hemispheres, cranial and spinal nerves, the autonomic nervous system.

9. The integument:

VI) HISTOLOGY:

Cytology:

1- Nucleus.

2. Cytoplasm: Cell organelles:(plasma membrane, Golgi complex, mitochondria, endoplasmic reticulum, lysosomes, ribosomes, centrosome, microtubules, filaments).

Cell Inclusions:(stored food, pigments). Cilia, microvilli and junction between the cells.

Basic tissues :

The epithelial tissue :(simple, stratified, glandular and neuro-epithelium).

The connective tissue :(connective tissue proper, cartilage, bone). The

muscular tissue :(skeletal muscle fibers, cardiac muscle fibers, smooth Muscle fibers). The nervous tissue :(neuron, nerve fibers, nerve trunk and ganglia).

III) The blood:

(Red blood corpuscles, white blood corpuscles and blood platelets).

IV) Systemic Histology:

The Aorta, Spleen and lymph node, Trachea and lung, Liver and pancreas, Stomach fundus and small intestine, Kidney, Testis Ovary Pituitary gland, Thyroid gland .

10. Spinal cord (cervical region).

VII) HUMAN CLINICAL PHYSIOLOGY:

A) Theoretical Part:

1. General survey:

Definitions and terminology. External and internal environments, Homeostasis and outlines of control systems.

2. Cell:

Cell functions, Cell membrane and transport, Nerve and muscle. Neuromuscular transmission.

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3. Blood :

General function of blood, Functions of plasma proteins, Homeostasis (mechanism and disorders), Red blood cells (functions, factors affecting erythropoiesis, anaemia, polycythaemia), Blood groups (A, B, O and Rh systems), White blood cells (functions, lymphatic tissue and immunity, allergy), Interferons, Blood volume and regulation of water balance.

4. Autonomic nervous system:

General functions, Organisation, Division, Autoregulation of various organs and systems, Autonomic reflexes, Neurotransmitters.

Ganglia: types, functions, outflow, receptors.

5. Cardiovascular system:

Dynamics and functions of cardiac muscle, Cardiac cycle, ECG, heart sounds, jugular venous pulse curve, Work of the heart, Heart rate and venous return and their regulations, Cardiac output and its regulation, Arterial blood pressure and its regulation, Special circulation (coronary, pulmonary, hepatic, cutaneous, cerebral, lymphatic, neonatal), Effects on Circulation by (exercise, haemorrhage, shock, anaemia), oedema.

6. Respiratory system:

External and internal respiration, intrapleural and intrapulmonary pressures, exchange of gases, dead space, volumes and capacities of respiration, oxygen dissociation curve, chloride-shift phenomenon, regulation of respiration: central and peripheral), apnoea, hyperpnoea, tachypnoea, dyspnoea, cough, sneezing, respiratory neonate, cyanosis and hypoxia, artificial respiration.

7. Digestive system:

Salivary gland: (types, function, control), chewing, swallowing and control, gut movements and secretion: (neural and chemical control), gut contents, vomiting definition and diarrhea, pancreas, liver, bile And jaundice.

8. Metabolism:

Metabolism rate and BMR, RQ and excess RQ, specific dynamic action, heat control and its disorders.

B) Practical part:

Selected experiments on the above topics.

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Third year

1) PHARMACEUTICAL ORGANIC CHEMISTRY (2):

A) Theoretical Part:

1. Aryl Halides:

Definition, Nomenclature, Methods of preparation, Physical properties, Chemical properties (Formation of Grignard reagents, Nucleophilic Aromatic Substitution, replacement by OH group, replacement by NH₂ group). The Mechanism of Nucleophilic Aromatic Substitution, Nucleophilic Substitution of Substituted Aryl Halides, Electrophilic Aromatic Substitution, Other Reactions (Wurtz-Fittig Reaction, Ullman Synthesis), The Influence of Substituent's on Reactivity in Nucleophilic Aromatic Substitution (Electron-releasing groups, Electron-withdrawing groups), Influence of substituents on orientation in Nucleophilic Aromatic substitution, Comparison of Aliphatic and Aromatic Nucleophilic substitutions.

2. Nitro Compounds:

Structure of Nitro Group, The Importance of Nitro Compounds, General Methods of Preparation (Aliphatic and Aromatic), Reactions of Nitro Compounds (Electrophilic and Nucleophilic Substitutions, Reduction Under Different Conditions).

3. Diazonium Salts:

Definition, Nomenclature, Methods of Preparation, The Mechanism of Diazotisation, Physical Properties, Chemical Properties (Replacement by -Cl, -Br or -CN Sandmeyer's Reaction, Replacement by -I, Replacement by -F, Replacement by -OH, Replacement by -H, Replacement by Aryl Group Reduction to Hydrazines, Coupling with Tertiary Amines, Reactions of Primary and Secondary Amines.

4. Phenols:

Definitions, Nomenclature, Preparations of Phenols, Physical Properties and Hydrogen Bonding. Chemical Properties (Acidity and Effect of Substituents on Acidity of Phenols, Ether Formation-Williamson Synthesis, Ester Formation, Halogenation, Nitration, Sulphonation,

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Friedel-Crafts Alkylation and Acylation, Koble Reaction, and Reimer-Thiemann Reaction, Phthalein Reaction with Ferric Chloride).

5. Sulphonic Acids and Their Derivatives:

Definition, Nomenclature, Preparations, Physical Properties, Chemical Properties (Reactions due to Ionisable Hydrogen, acidity, salt formation, Formation of Functional Derivatives, formation of sulphonyl chlorides, Replacement of Sulphonic Acid Group by -H, by-OH Group, by -NH Group, Reactions of Aromatic Nucleus, Derivatives of Sulphonic Acid (Chloramine T, Halazone, Saccharin, Sulphanilamide) .

6. Polynuclear Aromatic Compounds:

Definition, Bonding in Polynuclear Aromatic Compounds (Naphthalene, Anthracene, Phenanthrene), Nomenclature and isomerism of Naphthalene Derivatives, Physical Properties of Naphthalene, Chemical Properties of Naphthalene (Substitution reactions, Halogenation, Nitration, Sulphonation, Friedel-Craft's Reactions, The Mechanism of Substitution in Naphthalene, Addition Reactions, Reduction, Addition of Halogens, Oxidation, Orientation of Substitution in Naphthalene and its Derivatives, Effect of Activating and Deactivating Groups). Anthracene, Phenanthrene.

7. Heterocyclic Compounds:

Definition, Nomenclature of Monocyclic Rings Containing One or More Heteroatoms (Pyrrole, Furan, Thiophen, Imidazole, Oxazole, Thiazole, Pyrazole, Pyrroline, Pyrrolidine, Pyridine, Pyrimidine and Purine), Nomenclature of Bicyclic Rings Containing One or More Heterostoms (Purine, Quinoline, Isoquinoline, Carbazole), Aromaticity of Heterocyclic Compounds, Five-membered Heterocyclic Compounds (with One or two Heteroatoms), Electrophilic Substitution of Five-membered Rings, Six-membered Heterocyclic Compounds with One Oxygen as a Heteroatom (-Pyran, -Pyran, -Pyrone, -Pyrone and Their Derivatives), Six-membered Heterocyclic Compounds with One Nitrogen as a Heteroatom (Pyridine, Quinoline, Acridine and Their Derivatives), Reactions of Six-membered Heterocyclic Compounds, Six-memebered Heterocyclic Compounds with Two Heteroatoms (Pyridazine, Pyrimidine, Pyrazine and Their Derivatives). Condensed Systems Consisting of Pyrazine Ring Fused with Two Benzene Kings (Phenazine, Phenoxazine, Phenthiazine and Their Properties), Condensed Systems of Purine and Alloxazine, Purine

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Group (Hypoxanthine, Xanthine, Uric Acid, and Their Derivatives), Group of Alloxazine and Isalloxazine and Their Properties, Alkaloids, General Properties Alkaloids, Reactions of Alkaloids (The Formation of Simple Insoluble Sa such as Reaction with Tannin, Reaction with Picric Acid, The Formation Double Complex Salts such as Reaction with Mercuric Chloride, Reaction with iodine Solution, Reaction with Bismuth iodide), Alkaloids Classification (Pyridine and Piperidine Alkaloids Group, Quinoline Alkaloids Group ,Isoquinoline Alkaloids Group, Isoquinolinophenanthrene Alkaloids Group ,Tropane Alkaloids Group).

8. Spectroscopy:

A. Elemental Analysis

Elemental Analysis and Calculations (Qualitative Elemental Analysis Quantitative Elemental Analysis, Determination of the Molecular Weight) by the Vapour Density Method, by the Cryoscopic Method, by the Rast Method by the Neutralisation Equivalent, and by the Vapour Pressure Osmometry Method), Molecular Formulas, The Index of Hydrogen Deficiency.

B. Electronic Absorption Spectroscopy (UV NIS)

Definition, Electronic Energy Changes. Principles of Absorption Spectroscopy, The Relationship of max and max to Structure, Solvents Chromophores, The Effect of Conjugation, The Woodward-Fieser Rules for Dienes, Carbonyl Compounds, Solvent Shifts (a more detailed examination), Aromatic Compounds, Substituents with Unshared Electrons, Substituents Capable of Conjugation, Electron Releasing and Electron Withdrawing Effects, Disubstituted Benzene Derivatives, Polynuclear Aromatic Hydrocarbons and Heterocyclic Compounds, Model Compound Studies Visible Spectra, Color in Compounds.

C. Infrared Spectroscopy:

Introduction, The Infrared Absorption Process, Uses of the IR Spectrum, The Modes of Vibration and Bending (Symmetric and Asymmetric Stretching Vibrations, and in-plane and Out of Plane Bending Vibrations), Bond Properties and Absorption Trends, Examining IR Spectra, Correlation Charts and Tables, Analysis of IR Spectrum.

D. Nuclear Magnetic Resonance (NMR) Spectroscopy:

Introduction, Nuclear Spin States, Nuclear Magnetic Moments, Absorption of Energy, The Mechanism of Absorption (Resonance) The

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Chemical Shift and Shielding, The NMR Spectrometer, Chemical Equivalence, Integrals, Chemical Environmental and Chemical Shifts, Local Diamagnetic Shielding (Electronegativity Effects, Hybridisation Effects, Acidic and Exchangeable Protons, Hydrogen Bonding), Magnetic Anisotropy, Spin-Spin Splitting (N+1) Rule. The Origin of Spin-Spin Splitting, Pascal's Triangle, The Coupling Constant.

E. Mass Spectroscopy (MS):

The Mass Spectrometer, The Mass Spectrum, Molecular Weight Determination, Molecular Formulas from Isotope Ratio Data, Some Fragmentation Patterns, Additional Topics.

B) Practical Part:

1. Acetylation: acetanilide, ethylacetate, aspirin, pentacetylglucose, salicylamide.

2. Addition: osazones, hydrazones

3. Aromatic Electrophilic Substitution: nitrobenzene, 2,4-dinitrotoluene, azodyes

4. Reactions involving Cyclization: hexamine (hexamethylenetetramine), norantipyrine (norphenazone).

5. Miscellaneous: iodoform, Spectroscopic Techniques.

6. Infrared spectroscopy:

- schematic diagram of IR spectrophotometer .

- the principle of IR spectrophotometer.

- interpretation of spectra for different compounds .

7. UV/VIS spectroscopy:

- schematic diagram of UV/VIS spectrophotometer.

- the principle of UV/VIS spectrophotometer.

- interpretation of spectra (absorption bands for important functional groups) .

8. Nuclear Magnetic Resonance (NMR):

- schematic diagram of NMR spectrophotometer .

- the principle of NMR spectrophotometer.

- interpretation of spectra for different compounds.

9. Mass Spectroscopy (MS):

- schematic diagram of MS spectrophotometer.

- the principle of MS spectrophotometer .

- interpretation of spectra for different compounds.

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II) PHARMACEUTICAL ANALYTICAL CHEMISTRY (2):

A) Theoretical Part:

1. Acid-base titrations:

General considerations on titrimetric analysis, Theoretical bases on neutralization reactions, Neutralization indicators, colourimetric determination of pH, Neutralization titration curves, Applications of neutralization reaction, Titration in non-aqueous media.

2. Redox titrations :

Redox theory, Redox indicators, Redox reactions involving iodine, Redox reactions involving potassium permanganate, Redox reactions involving potassium dichromate, General applications of redox reactions.

3. Potentiometric Methods:

Introduction, End point determination, Application of potentiometric titrations .

4. Polarography and Amperometry:

5. Conductometry:

6. Spectrophotometric Analysis :

light and radiation, interaction of photos with matter, Spectral band characterization, Types of electronic transitions, Absorption characterization of chromophores, Calculation of wavelength of maximum absorption, Solvents and buffer effects, Instrumentation, Quantitative spectrophotometry, Application of spectrophotometry.

7. Solvent Extraction:

The distribution coefficient, The distribution ratio, The percent extracted, Analytical separations, Solid-phase extraction, Solid-phase extraction by flow injection analysis.

8. Chromatographic methods

Principles of chromatography, Classifications of chromatography techniques, Techniques of column chromatography, Column efficiency in chromatography, Ion exchange chromatography, Gas chromatography, High-performance liquid chromatography, Paper chromatography, Thin-layer chromatography, Electrophoresis.

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Practical Part:

Simple acid radicals (groups I, II, III and mixtures), Acid radical mixtures without interference and with interference, Interfering acid radical mixtures, Organic acid radicals. Basic radicals (silver group, copper-arsenic group, iron group, zinc group, alkaline-earths group, alkali metal group), Interference in cation analysis (oxidizing agents, organic matter, insolubles, phosphate, (Precipitometric titrations :Determination of chloride by Mohr's and Fajan's method, bromide by Volhard's method, Determination of zinc salts, Determination of chloride and iodide mixture, Determination of HgCl₂, Complexometric titrations:Determination of Cu²⁺, of mixture of (Ca²⁺ and Mg²⁺) and of Zn²⁺, Gravimetric analysis:Determination of Ca²⁺ as oxalate, and Ni²⁺ as dimethylglyoximate.

GENERAL PHARMACOGNOSY:

Theoretical Part:

The Course deals with the study of the drugs of natural origin, emphasizing the following: Definition, Botanical origin, Geographical source, History, Collection and preparation Macro and microscopical characters, Characters of the powdered drug, Active constituents Chemical tests, Action and uses of the drug.

Production

Definition, Importance and function of pharmacognosy, Crude, Official and unofficial drugs.

Nomenclature of drugs :(botanical, geographical and commercial sources of drugs).

Classification of drugs :(alphabetical, taxonomical, morphological, pharmacological and chemical).

Cultivation :(disadvantages of collecting wild plants, advantage of cultivation).

collection :(time of the year, time of the day, stage of the development of the plant, general rules of collection).

Drying: Natural methods. artificial methods. changes occurring after drying) Preservation and protection of crude drug: (deterioration during storage, physicochemical factors, biological factors, methods to destroy and control of insects).

Adulteration :(sophistication, substitution, admixture and deterioration).

Chemistry of the active constituents:(food storage products such as starch, proteins and fixed oils and fats, products of metabolism such as

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crystals, gums and mucilage, resins, tannins, alkaloids, volatile oils and glycosides).

Medicinal leaves:

Introduction to morphological and anatomical description of the leaves, Study of the following medicinal leaves: Digitalis, Senna, Stramonium, Belladonna, Hyoscyamus, Bucho, Beido, Coca, Jaborandi, Uva-Ursi, Ivy and Henna.

Medicinal barks:

Introduction to morphological and anatomical description of the bark, Study of the following medicinal barks: Cinchona, Cinnamon, Cassia, Cascara, Frangula, Quillaia, Pomegranate, Hamamelis and Galls.

Medicinal subterranean organs (Roots and Rhizomes)

Introduction to roots, rhizomes, bulbs, corms, stem tubers and root tubers, Study of the following medicinal subterranean organs: Liquorice, Ipecacuanha, Rauwolfia, Senega, Ginger, Colchicum, Squill, Valerian, Ginseng, Rhubarb, Filix-mas, Curcuma, Podophylum, Aconite, Jalap. VERATRIUM, Sarsaparilla, and Kava-kava, Krameria.

Medicinal flowers:

Introduction to flowers, flower buds inflorescence and placentation, Study of the following medicinal flowers: Cloves, Chamomile, Pyrethrum, Arnica, Tilia, Santonica, Lavender and Saffron.

Medicinal seeds:

Introduction, macroscopical and microscopical characters of seeds, Study of the following medicinal seeds :Cardamom, Colchicum, Nux-vomica, Linseed, Nutmeg, Black and white Mustard, Fanugreek, Clabar and Nigella. medicinal fruits Definition and introduction, classification, microscopical and macroscopical characters of fruits. Study of the following medicinal fruits :Ammi vinaga, Anise, Fennel, Caraway, Capsicum, Ammi majus, Star-Anis, Coriander, Vanilla, and Senna.

Medicinal herbs:

Introduction to herbs, Study of the following medicinal herbs: Ergot, Indian hamp. Catheranthus, Lobelia, Peppermint, Thyme, Pass flora, and Ephedra.

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MEDICINAL Unorganized drugs:

Definition, classification, chemical and physical properties, Study of medicinal resins and resin-combinations: Colophony, Myrrh, Toluperu, Tolu Balsam, Olibanum, and Benzoin, Study of the medicinal Gums: Gumi arabic, Tragacanth, Study of the medicinal Latex: Opium, Study of the medicinal Juice: Aloe, Study of the medicinal extracts: Agar, Gelatin, and Kino.

Practical Part:

Laboratory work deals with the morphological microscopical and chemical characterization of certain important drugs and their powders that have been treated in the theoretical part.

PHARMACEUTICS (2):

Theoretical Part:

coarse Dispersions :

Suspensions: Interfacial properties. Setting and sedimentation parameters, formulation of suspensions. Pharmaceutical suspension product :(oral, magma, milk, mixtures, lotions). Assessment of suspensions.

Emulsions: Theory and types, Formulation, Physical stability, Pharmaceutical emulsion products, Evaluation of emulsion stability.

Semisolid Dosage Forms:

1.Ointments: Percutaneous absorption, Types of ointment bases, Methods of preparation, Pharmaceutical application.

2.Gels

3. Pastes

4. Creams

Rheology:

Newtonian systems, Non-Newtonian systems, Thixotropy, Determination of rheological properties, Application in pharmacy.

Suppositories:

Rectal drug absorption, Types of bases, Methods of preparation, Pharmaceutical uses.

Aerosols:

Components of aerosol package, Formulation of pharmaceutical aerosols. selection of components, Manufacturing of pharmaceutical aerosol, Quality control.

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VI) Micrometrics:

Particle size distribution, Methods of particle size determination, Particle Shape and surface area, Surface area determination, Pore size.

VII) Solid Dosage Forms:

1. Tablets:

Tablets ingredients, Tablet preparation, Problems in tablet manufacture, Types and classes, Tablet coating, Quality control.

2. Hard and soft gelatin capsules:

Reasons for encapsulation, Composition of the shell, Formulation, Machineries used, Problems encountered, Quality control.

3. Powder and granules:

Definition, Classification, Advantages and disadvantages, Problems encountered .

VIII) Sustained release dosage form:

a. drug selection b. sustained release oral products .

c. sustained release parenteral products.

d. new trends in sustained release dosage forms .

IX) Laws Governing the Practice of Pharmacy:

B) Practical Part:

1. Measurement of viscosity by Ostwald viscometer, effect of glycerin concentration.

2. Preparation of emulsion. O/w emulsion, W/o emulsion.

3. Preparation of suspensions :Dispersible drugs, Using wetting agents, Suspending agents.

4. Determination of sedimentation rate.

5. Preparation of ointments and creams (Simple ointment, Cold cream, Vanishing cream).

6. Preparation of suppositories using different suppository bases, and calculation of displacement value.

7. Preparation of divided powders: packet .

8. Determination angle of repose and effect of glidants.

9. Preparation of effervescent granules.

10. Determination of void volume (pore size).

11. Fill- of capsules (punch method)

12. Preparation of selected compressed tablets.

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PHARMACEUTICAL MICROBIOLOGY:

Theoretical Part:

Medical Bacteriology:

- a. Bacteria, organization, structure, and taxonomy.
- b. Bacterial genetics.
- c. Growth and nutrition of bacteria.
- d. Laboratory methods of bacterial disease diagnostic.

Medically Important Bacteria:

- a. Gram-positive cocci, Staphylococci, Streptococci,
- b. Gram-negative cocci – Neisseriae.
- c. Gram-positive rods, Bacillus, Colstridium, Corynebacterium,
- d. Gram-negative rods, Pseudomonas, Vibrio Cholerae, Bordetella, Haemophilus.
- e. Escherichia, Salmonella, Shigella, Proteus, Serratia-Marcescens, Bacteroids, Legionella .
- f. Mycoplasmas, Chlamydiae, Ricktsiae.

1. Antibiotics

Antibiotics and synthetic antimicrobial agents, Mechanism of action of antibiotics, Bacterial resistance to antibiotics. Clinical uses antimicrobial drugs, Chemical disinfectants, antiseptics and preservatives, Antimycotic and antiviral drugs (their mechanism of action), Principles and practice of sterilization, Sterility testing, Sterile pharmaceutical products, Bacteriophages, Microbial genetics.

V) Virology:

General properties of viruses. Classification of viruses, DNA containing viruses, RNA containing viruses, Principles of virus structure, reproduction of viruses, Measuring the size of viruses, Chemical composition of viruses, cultivation and assay of viruses, Quantitation of viruses, Purification and identification of viruses.

V) Immunity:

Immunogenicity and antigenic specify. Innate immunity, Barriers against Infection Phagocytic cell kill micro-organism, Complement facilitates phagocytosis, Humoral mechanism provides a second strategy. Extracellular killing, The need for specific immune mechanism, Immunglobulins: Nature of immunoglobines - Basic structure and terminology, Biological activities of immunoglobine molecules,

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Serologic reactions: Allergy hypersensitivity reactions, Classification of hypersensitivity.

VI) Mycology:

1. General properties of fungi.
- 2- Classification of fungi.
3. Medically important fungi: Superficial mycosis, coetaneous mycosis, Systemic mycosis, Pathogenic yeasts (Candida albicans, Cryptocollrsneoformans).

B) Practical Part:

Selected experiments on the above topics.

VI) BIOCHEMISTRY:

A) Theoretical Part:

1- Carbohydrate Chemistry:

(Carbohydrates: Chemistry, Digestion and Absorption).

- 1- Classification: mono, di- and polysaccharides .
2. Monosaccharide's: subclasses, D, L-cyclic, chain structure and rotation (+8-)

2.1. General properties:

- a- Formation of esters, 6-phosphate esters
- b- Reduction
- c-Action of acids
- d-Oxidation of sugars
- e-Osazone formation
- f-Yeast fermentation

2.2. Derivatives :

- a-deoxysugars
- b-amino sugars
- c- sugar alcohol
- d- Sugar acacias

Disaccharides: General properties, Structure, Reducing. Non-reducing maltose, lactose, Sucrose, Celiobloss.

Disaccharides examples.

Polysaccharides: General properties, Structure.

- 1- Homopolysaccharides: Starches (Amylose, Amylopectin, Dextrin, Glycogen and Cellulose).
2. Mucopolysaccharides:Classification, Structure, Hyaluronic acid, Heparin, Chondroitin's.

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3. Digestion: Amylases (Salivary, Pancreatic), Maltase's, Lactases, Surceases.

4-Absorption: Different theories.

Lipid Chemistry:

(Lipids: Chemistry, Digestion and Absorption),

Classification: simple, compound.

1- **Simple lipid:** structure, fatty acids (saturated and unsaturated).

2- Natural fats: simple, mixed,-physical and chemical properties, Hydrolysis of fats, Saponification, iodine No., Rancidity, hydrogenation of oils.

3. Waxes: Bee's wax, Lanoline.

2- **Compound lipids:** General structure

1- Phospholipids: phosphatidic acid, lecithin, cephalixin's, lipositols, Sphingomyelins, galactolipids, lipoproteins (structure, properties for each).

2. Steroids: nucleus, structure of cholesterol and other steroids.

3. Digest lipase bile sits.

4. Absorption: abstract of absorption.

Protein chemistry:

(Protein Chain Protein 3, amino acids and nucleic acids: Chemistry, Digestion and Abruptic.

1-Amino acids: Classification, Structure (neutral, acidic, basic) and subclasses.

2-Properties of amino acids: general, amino and carboxylic properties (some of each). Polypeptides and protein structure.

3-properties of proteins general, denaturation, colour reactions, precipitation (With salts, alkaloidal reagents, heavy metals).

4- Classification of proteins.

IV. Vitamins: Fat soluble and water soluble.

V- Enzymes: General properties, Factors affecting them.

General Basic Metabolism

I) Carbohydrate Metabolism:

1- Absorption, Passive diffusion, Active transport .

2-Terminology:(Hyperglycemia,Hypoglycemia,Glycosuria,Glycogenesis, Glycogen lysis, Glycolysis, Gluconeogenesis, Fate of absorbed sugar in the liver)

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3- Glucose oxidation (Glycolysis) :

a- Anaerobic phase (Embden-Meyerhoff Pathway), with special reference to enzymes, Pasteur Effect and fermentation.

b- Aerobic phase (Krebs's Cycle):

- Oxidative decarboxylation of pyruvic acid to Acetyl-CoA.
- Reaction steps Involved in Krebs's Cycle with reference to enzymes and Co-enzymes required for each step.
- Link between proteins (glycogenic amino acids), carbohydrate and lipid metabolism.
- Significance of Krebs's Cycle.
- Energy yields from complete oxidation of one molecule of glucose.
- Glycogenesis and glycogen lysis in liver and muscles with special reference to enzymes and hormonal control (effect of adrenaline and insulin), different between liver and muscle glycogen.
- Glycogenesis importance, metabolism, sources of control.
- Role of the liver in carbohydrate metabolism and energy for muscle contraction.

4- Blood glucose:

a- Sources, removal, factors affecting blood glucose level (tissue and Hormonal).

b- Metabolic changes occurring in Diabetes mellitus.

C-Pentose phosphate pathway (HMP-Shunt).

II) Lipid Metabolism:

1. Digestion and absorption of lipids, lipids of the body.
2. Blood lipids, plasma lipoproteins, oxidation of fats, fatty acids, biogenesis of fatty acids, cytogenesis, ketoses, cytolysis.
3. Regulation of lipogenesis, carnitine, biosynthesis of glycerides, biosynthesis of phospholipids.
4. Degradation of phospholipids - function of phospholipids.
5. Metabolize of essential and non-essential fatty acids.
6. Propionate metabolism, Cholesterol metabolism.
7. Cholesterol and atherosclerosis, role of liver in lipid metabolism, fatty liver and lipotropic factors.

III) Protein Metabolism:

- Digestion and absorption, biological value of proteins.
- Essential and non-essential amino acids, nitrogen balance.
- Amino acid pool: general metabolic reactions of proteins.
- Fate of ammonia, fate of ketoacidosis.
- Protein biosynthesis: Creating, creatinine.

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-Special metabolic pathways of amino acids :Glycine, Sulphur containing amino acids (cysteine, cysteine and methionine), phenylalanine, tyrosine, tryptophan, histidine basic amino acids (arginine and lysine), acidic amino acids (glutamic acid and aspartic acid).

-Metabolism of nucleoproteins: Catabolism of purines and pyrimidines.

Practical Part:

-Blood glucose.

-Glucose tolerance test (normal - abnormal).

-Estimation of:

a-serum proteins

b-serum albumin

c-blood urea

d- blood uric acid

e-blood creatinine

f-total lipids

II) PHARMACOLOGY (1):

Theoretical :

1.General Pharmacology

2.Principles of drug actions ;

a. pharmacokinetics

b. pharmacodynamics

3. Autonomic Drugs

a. parasympathomimetics

b. parasympatholytics

c. sympathomimetic

d. sympatholytic

e. drugs acting on autonomic ganglia

4. Autacoids

a. endogenous amines

b. polypeptides

c. lipids

5. Local anesthetics and analgesics

6. Drugs acting on GIT

7. Drugs acting on respiratory system

B) Practical Part:

-Experiments on locally acting drugs.

-Astringents, demulcents and emollients.

-Action of drugs on the CNS.

-General stimulants.

-General depressants.

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MEDICINAL CHEMISTRY (1)

A) Theoretical Part:

Inorganic :

Limit tests, Official inorganic acids and bases, Inorganic compounds acting on the GIT, acidifying agents, antacids, Protective adsorbents as antidiarrheal agents, purgatives, Tonic iron preparations, sweetening agents, flavoring agents.

Autonomic Nervous System :

Adrenergic drugs (sympathomimetic), Adrenergic blockers, alpha & beta blockers, Cholinergic drugs, direct cholinergic, indirect cholinergic : (reversible - irreversible), Cholinergic blockers : Solanaceous alkaloids (Belladonna alkaloid), Esters of tropane, Esters of amino alcohols, Ethers of tropine, Amino alcohols, Diamines, Amino-amides, Ganglionic blockers, Neuromuscular blockers.

II) Cardiovascular Agents:

Coronary vasodilators, Rapid acting drugs, Slow acting drugs, Antiarrhythmic drugs, Coagulants and anticoagulants, Hypotensives and antihypertensive.

IV) Diuretics:

Mercurial, Carbonic anhydrous inhibitors, Benzothiadiazines, Loop diuretics, Miscellaneous.

IIV) Central Nervous System Depressants:

General anesthetics, Inhalation anesthetics :(liquid anesthetics- gas anesthetics), Basal anesthetics, Parenteral anesthetics, Sedatives and hypnotics, Barbiturates :(long, intermediate, short, ultrashort acting), Non-barbiturates: acyclic urides (Carbromal), amides and imides (Glutethimide), alcohols (Chlorobutol), aldehydes, sodium bromide and potassium bromide). Anticonvulsant drugs: Barbiturates, Hydrations, Oxazolidinediones, Succinimides, Primidone, Central Relaxants: CNS depressant with skeletal muscle relaxant properties, Tranquilizers: Phenothiazine derivatives, Thioxanthine derivatives.

VI) Central Nervous System stimulants :

Analeptics, Psychomotor stimulants, Sympathomimetic central stimulants.

Monoamine Oxidase Inhibitors (MAOI), Tricyclic antidepressants

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(Mood elevator).

VII) Local Anaesthetics:

VIII) Analgesics :

Narcotic analgesics, Morphine, Synthetic morphine substitutes, Narcotic antagonists, Antipyretic analgesics: Salicylates, Para-Aminophenol derivatives, Pyrazolone and pyrazolidinedione derivatives, Miscellaneous class aryl acetic acid derivatives.

IX) Antitussives.

X) Histamine and Antihistamine Drugs

B) Practical Part:

Selected experiments on the above topics.

II) PHYTOCHEMISTRY:

A) Theoretical Part:

1- Chromatography:

Basic concept (partition and adsorption chromatography). Separation techniques (elution, frontal, and displacement analysis), types of chromatographic methods: Paper chromatography, thin layer chromatography (TLC), Column chromatography (CC), Gas chromatography (GC), Highperformance liquid chromatography (HPLC), Gel chromatography.

II. Alkaloids:

Introduction: Definition, history, occurrence, classification, nomenclature, physical and chemical properties, isolation, purification and detection.

1-Alkaloids derived from phenylalanine and tyrosine :

- Phenylalkylamine-alkaloids: (ephedrine, cathinone, capsaicinoids)
- Isochinolin-alkaloids (papaverine, morphine, codeine, and emetine)
- Troponin-alkaloids (colchicine, demecolcine).
- Amaryllidacean-alkaloids (licorice, galanthamin)

2-Alkaloids derived from tryptophan

- Indole-alkaloids (physostigmine-, Caroline, ergo line-, ajmalicine-yohimbine-, ajmaline, and strychnine-type)
- Chino line-alkaloids (Cinchona-alkaloids).

3-Alkaloids derived from histidine:(Pilocarpine, is pilocarpine, piscine).

4-Alkaloids derived from asparagusic acid:ricinine and Nicotine-alkaloids).

-Alkaloids derived from lysine.

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- Piper dine-alkaloids (Piper, Lobelia., and Pomegranate-alkaloids)
- Chinolizidine-alkaloids (lupinine, sparteine, and cytosine)
- 5-Alkaloids derived from ornithine.
- Tropan-alkaloids (atropine, hyoscyamine, scopolamine and cocaine)
- Chinazoline-alkaloids (tetradoxine) .
- 6-Alkaloids derived from glycine.
- Purim-alkaloids (caffeine, theophylline, and theobromine).
- Terpene-alkaloids :(monoterpene-, sesquiterpen-, and detergent-alkaloids).
- Steroidal alkaloids:(Veratrin-alkaloids).

III-Terpenoids :

- Introduction (definition, classification, biosynthesis and distribution).
- Monoterpenes:(regular- and irregular monoterpenoids, iridoids, structures, chemical and physical properties and drugs containing monoterpenoids).
- Sesquiterpenes and sesquiterpen lactones :(structures, chemical and biological properties, and drugs containing sesquiterpenes and sesquiterpen lactones).
- Diterpenes:(structures, chemical and biological properties, and drugs containing triterpenes).
- Triterpenes:(classification, structures, and drugs containing triterpenes).
- Tetra terpenes:(chemical and biological properties, vitamin A, and drugs containing tetra terpenes).

IV. Volatile oils :

- Definition, classification, distribution and occurrence.
- Preparation: distillation methods and solvent extraction.
- Chemical and physical and pharmacological properties.
- Drugs containing volatile oil used as counter-irritating agents, expectorants, and diuretic and as stomachic and carminative.

V- Steroids :

- Definition, classification, structures, biogenesis, chemical and physical properties, characterization.
- Sterols (Definition, classification, structures, chemical and physical properties, Pharmacological Importance).
- Vitamin D (Sources, structure, action, clinical uses)
- Bile acids (Structure, action and uses)
- Steroid hormones (Sexual hormones and corticoids, classification, structure, action and clinical uses).

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VI-Glycosides:

Introduction :(Definition, classification, distribution extraction and isolation, pharmacological properties).

Cardio active glycosides:(cardenolides, bufadienolids, sugars, structure-activity-relationship, distribution, extraction, chemical and physical properties, hydrolysis of cardiac glycoside, biogenesis, pharmacological properties, mechanism of action, chemical tests, chief drugs containing cardiac glycosides, Digitalis, Strophanthus, Adonis, Convalaria and Squall). Saponin-glycosides:(Definition, distribution, classification, structures, biogenesis, extraction, chemical and physical properties, Characterization, biological and pharmacological properties, drugs as expectorant and antitussive, anti-exudative, Adaptogens and as diuretic).

Anthracene glycosides:(distribution, classification, structures, biosynthesis, extraction, chemical and physical properties, characterization, pharmacological properties, Senna, Rhamnus, Rhabarub and Aloe).

Flavonoid glycosides:(Classification, biosynthesis, chemical structure, physic-chemical properties, extraction, characterization, biological properties, rut in, hesperidin and Flavonoid containing drugs).

Cyanogen tic glycosides:(Cytogenesis, distribution, structure, biogenesis properties, detection, extraction, pharmacological activities, and cyanogen etc plants). Glucosinolates (Thioglycosides):(Definition, distribution, structure, biogenesis, Hydrolysis, toxicity and drugs containing glucosinolates).

VII- Tannins :

Definition, classification, structure, hydrolysable- and condensed-, complex and pseudo-tannins, distribution, biosynthesis, physic-chemical properties, characterization, extraction, biological properties and drugs containing tannins).

VIII- Phenyl propane-derivatives:

Introduction:(definition, classification, and biogenesis).

Phenols and phenolic acids :(Structures, physic-chemical properties, characterization, extraction, pharmacological properties and drugs containing Phenols and phenolic acids).

Coumadin's:(definition, chemical structures, classification, biosynthesis, physic-chemical properties, characterization, extraction, pharmacological

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properties and uses, drugs containing coumarone, furocoumarin, Pyranocoumarines).

Lignin's:(definition, classification, distribution, biological and pharmacological properties, and drugs containing lignin's).

Lignin:(definition, structure, biological and pharmacological properties of some lignin's).

k -Bitter principles:

Definition, classification, chief drugs containing bitter principle.

-Practical part:

- Some chromatographic separations using paper, thin-layer and column chromatography.
- Extraction of some alkaloids-containing drugs, chemical tests and separation of the active compound using chromatographic methods.
- Extraction of some glycosides-containing drugs, evaluation of the active constituents using chemical tests chromatographic methods.
- Extraction of some volatile oil-containing drugs, estimation of the principle constituents using chemical tests chromatographic methods.
- Extraction of some tannins-containing drugs, chemical tests and Separation of the compound using chromatographic methods.

II) PHARMACEUTICS (3):

(BIOPHARMACEUTICS AND PHARMACOKINETICS):

A) Theoretical Part:

BIOPHARMACEUTICS:

1- Terminology and Definitions

2- Drug Absorption:

a. Mechanism of Drug Absorption

b. Factors affecting Drug Absorption:

Biological factors, physio-chemical factors, effect of dosage forms

C- Dissolution Rate of Drugs: Methods of Determination, Limits, In Vitro/InViv. Correlation .

d- Drug Distribution, and Binding to Plasma Protein

e-Drug Metabolism

f- Drug Elimination, Mechanism and Factors affecting it.

g-Bioavailability and Bio equivalency.

II) PHARMACOKINETICS:

1- Terminology and Definitions

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- 2- Kinetics of Drug Absorption
3. Compartment Model:
 - a- One compartment model
 - b-Two compartment model
 - C-Absorption model
 - d-Blood level data analysis
 - e-Urine data analysis
- 4- Determination of Pharmacokinetics Parameters.
5. Renal Clearance.
- 6- Hepatic Clearance.
7. Multiple-dose Administration and Dose Interval
- 8- Kinetics in the Evaluation of Drugs and Drug Products.

III) Dosage form design:

- 1 - Pre-formulation :
 - a- crystal structure and polymorphism
 - b- particle size and shape
 - C-Solubility de stability and dissolution rate
 - e-Partition coefficient
- 2- Formulation of solid dosage forms:
 - a-formulation of powders and granules
 - b- formulation of capsules
 - C- Formulation of tablets
3. Formulation of parental:
 - a- selection of solvent system
 - b- additives and their role.

Practical Part:

Tutorials and problems on:

- One compartment model
- Two compartment model
- Absorption model
- Clearance types and calculations
- Bioavailability and bioequivalence
- Drug plasma protein binding

Experiments on:

Dissolution rate, Calculation of dissolution order (First, zero and diffusion) Drug plasma protein binding and calculation, Drug diffusion through membranes.

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-Example experiment for preparation and follow up of:
Powders, Tablets, Injections, Creams Ointment, Sustained release products Polymer matrix, Solvent evaporation coated product.

PHARMACOLOGY (2):

1)Theoretical Part:

1.Cardiovascular drugs

a. cardiac glycosides

b. antihypertensive drugs

C. anti-arrhythmic drugs

d. vasodilators

2.Drugs acting on blood and blood forming organs

a. anticoagulants

b. anti-anemic (vitamins)

3.Drugs affecting renal function (diuretics)

4.Drugs acting on CNS:

a. general depressants.

b. general stimulants

c. selectively acting drugs

5. Drugs acting on Liver

6. Drugs acting on Endocrine

7. Drug-drug interaction

8. Antibiotics

9. Antimalarial

10. Anticancer

Pharmacological Methods used in QCD:

1) Pre-experimental Aspects:

Introduction.

- Handling of experimental animals .
- Channels of drug administration .
- Techniques of producing unconsciousness in laboratory animals .
- Concentration of drugs.
- Standard drugs and chemicals .

2) Experimental Aspects:

2.1) Qualitative Experimental Pharmacology:

- Experimental pharmacology of isolated tissue preparations
- effect of drugs on isolated frog rectus abdomens muscle
- effect of drugs on isolated rabbit muscle.
- Experimental pharmacology of intact animals:

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- evaluation of local anesthetics.
 - study of mydriasis and mitotic.
- effect of drugs on blood pressure of anaesthetized rat or cat

2.2) Quantitative Experimental Pharmacology:

- Theoretical aspects of bioassay .
- Experimental aspects of bioassay:
 - bioassay of acetylcholine .
 - bioassay of adrenaline and noradrenaline .
 - pyrogen test.

B) Practical Part:

- Experiments on isolated.
- Effect of drugs on the isolated toad's heart
- Determination of site of action of an unknown drug on the isolated.
- toad's heart Effect of drugs on rabbit's intestine.
- Determination of the site of action of unknown drug on the rabbit's intestine Spasmogens and their specific antagonists on the guinea pig's ileum, Dose response curve using acetylcholine on toad's rectus abdominis.
- Demonstration of the effect of anticlineestruces and neuromuscular blocking agents using the toad's rectus abdominis muscle.

TOXICOLOGY AND FORENSIC CHEMISTRY:

Toxicology:

- Classification of poisons .
- Mechanism of action of poisons.
- Treatment of poisons :(first aid measure in any case of poisoning).
- Antidotes and antidotal mechanisms Drug-drug interaction, Corrosives, Metallic poisons, Plant poisons, Gaseous and volatile poisons, Insecticides and rodenticides, Food and animal poisoning, Teratology, Carcinogens, Barbiturates, Sedatives, and Analgesics.

Forensic Chemistry:

Extraction of poisons or "drugs" from human biological materials or from anybody remains.

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1) Toxicological screening:

A- Preliminary tests:

1. Dip-strip e.g. pH, Protein, glucose, Cyanide, etc.
 2. Color-reactions with reagents e.g. Salicylates, phenols, paracetamol, halogenated hydrocarbons, etc.
- Immunochemical methods e.g. EMIT, Ontrak, etc.
3. Extraction procedures:
- Liquid-liquid extraction.
 - Lon-pair extraction.
 - Liquid-solid extraction
 - Special techniques: e.g. continuous extraction, etc.

C-Identification procedures :

- 1-TLC.
- 2- HPLC
- 3-G.C
- 4- UV/VIS-spectrophotometry.
- 5-Infraredspectrophotometry.

VI) GENERAL PATHOLOGY:

A) Theoretical Part:

Introduction: Definition of pathology, Role of pathology in medicine, Normal structure and function, Nature and classification of diseases. Cell and tissue damage, Degeneration causes, types and effects. Necrosis causes and types. Inflammation and repair, Causes of the inflammatory response, Acute Inflammatory reaction types and cells, chronic inflammatory reactions types and calls. Power of tissues to repair, Healing of skin wounds, Healing of bone fracture, Regeneration and factors affecting the process of repair.

-Bacterial infections:

Modes and effects of bacterial infections, Pathogenicity of micro-organisms, Tonsillitis, Osteomyelitis and typhoid fever, Diphtheria, Bacillary dysentery and tetanus.

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-Viral infections:

Differences between virus and bacteria, Tissue reaction to viral infection, Poliomyelitis and viral hepatitis, Rabies, Influenza and Mumps, Measles and German measles, Herpes simplex and Zoster.

-Some fungal infections:

Tinea and Moniliasis, Actinomycosis and Madura foot.

-Parasitic infections :

Schistomiasis (urinary and intestinal), Hydatid disease and Filariasis, Amoebiasis and Leishmaniasis.

-Abnormal tissue deposits: Amyloid, uric acid and urates and cholesterol, Calcium, Melanin and Hemoglobin derivatives.

Disturbances of growth:

Normal development and maturation of tissues. Failure of development, Atrophy and Hypertrophy, Hyperplastic, Metaplasia and Dysplasia, Vascular and pigmented hamartomas.

Neoplasia (tumors) : Etiology of tumors, Benign, Malignant and locally malignant, Benign tumors, epithelial and Mesenchymal, Carcinoma and Sarcoma character, Grading and Staging. Prognosis, causes of death and prevention of malignant tumors.

B) Practical Part:

Selected experiments on the above topics.

VII) GENERAL PARASITOLOGY:

A) Theoretical Part:

I) PARASITOLOGY:

-Life-cycles of important parasites.

- Laboratory diagnosis, prevention and control of parasitic infections.

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3. Wound and contusions :

- Types of wounds.
- Complications associated with wound.
- First Aid for wound.

4. Shock:

- Types, Signs and symptoms of shock, First Aid for shock.

5. Burns and scalds:

Causes, Complication of burn, First Aid for each type of burns (flame, electric, chemical. Etc.).

6. Fractures. Dislocation and sprains :

Causes, Classification of fracture, Signs and symptoms of fracture, Strains and sprains, Dislocation, General principles of First Aid.

7. Asphyxia:

- Causes, Signs and symptoms, General principles of First Aid.
- Artificial respiration, Mouth to mouth breathing , external cardiac massage.

8. First Aid treatment for:

Drowning- electric shock-choking, carbon monoxide poisoning.

9. Loss of consciousness :

Level of consciousness, Causes of unconsciousness, General examination of the patient,

- Fainting and syncope
- Fainting and convulsions

10. Epilepsy: Types, Signs and symptoms, First Aid.

11. Diabetes :

Signs and symptoms of diabetic coma.

Signs and symptoms of insulin coma.

12. Heat stroke: Signs and symptoms

13. Poisoning:

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- Classification, Aims and First Aid in poisoning, Signs and symptoms of sp. poisoning.

First Aid treatment for each: Bites, sting, foreign bodies: (ear, eye, nose).
Frost bite and sunburns.

PUBLIC HEALTH:

Theoretical Part:

- Vital statistics.
- Demography and family planning.
- Host-parasite relationships.
- Immunity .
- Epidemiology of communicable diseases and their laboratory diagnosis.
- Occupational health.
- Nutrition and food sanitation.
- Environmental health (air, water, sewage, refuse and vector control).

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Fifth Year

MEDICINAL CHEMISTRY (2):

A) Theoretical Part:

Chemotherapy:

Sulphonamides : Introduction, mechanism of action, SAR, general methods of synthesis, general methods of analysis, nomenclature.

Classifications : Topical sulphonamides, Short acting and long acting sulpha drugs, Urinary sulpha drugs, Locally acting sulpha drugs.

Anti-mycobacterial drugs (chemotherapy of acid-fast infections): Antileptotics (sulphonyls), Ant tuberculosi s drugs, Antiprotozoal agents, Local anti-infective agents (Antiseptics and disinfectants), Antibiotics :

B- Lactam antibiotics, Aminoglycoside antibiotics, Macrolides, Chloramphenicol, Tetracycline's, Antifungal antibiotics, Cysto-toxic drugs (Antineoplastic). Alkylating agents, Antimetabolites, Antifungal agents, Antiviral compounds .

1) Hormones :

Steroidal Hormones : Sex hormones, Synthetic non-steroidal hormones, Adrenocortical hormones, Oral contraceptives, Non-steroidal hormones : Thyroids, ant thyroids, Pancreatic hormones and oral hypoglycemic agents Pituitary hormones : Hormones of the anterior pituitary (adenohypophysis), Hormones of the posterior pituitary (neuro hypophysis) .

1) Vitamins :

Fat soluble vitamins, Water soluble vitamins .

IV) QUALITY CONTROL OF DRUGS:

Physical and Physic-Chemical Methods used in QCD:

Introduction : Tasks and aims of Quality Control of Drugs , Standard references for QCD, Methods for separation of mixtures of substances.

Analytical basic operations : centrifugation

Distillation, crystallization, sublimation, extraction with solvents.

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-Methods of Chromatography:

adsorption chromatography (column chromatography cc), paper chromatography (PC), thin layer chromatography (TLC), Ion-exchange chromatography (IEC), paper electrophoresis, gas chromatography (GSC & GLC), high performance liquid chromatography (HPLC), isolation of active ingredients from dosage forms.

i)physical and Physic-Chemical Methods:

Determination of physical constants : density, relative density and weight per ml Solubility, viscosity Exchange of thermal energy:, determination of m.p. and freezing point determination of b.p., Determination of refractive index., Determination of optical rotation and specific rotation, Emission and absorption of electromagnetic energy,UV/VIS Spectrophotometry.

i- Spectroscopy:

- Potentiometry
- Chemical Methods: Identification of organic compounds:
- Formation of azo compounds (dyes): identification of nitrites, prim aromatic amines, nitro groups, phenols, amines.
- Formation of Quinone's : oxidation in acidic solutions, oxidation in alkaline solutions, oxidative condensation.
- Formation of mesomerism stabilized cations : addition of acids, Furfural reaction, reaction with p-dimethylaminobenzaldehyde, diphenyl methane's, Ox onium and carenum ions.
- Formation of mesmerism stabilized anions.
- Formation of colored coordinated compounds : reaction with $FeCl_3$ (Fe-complexes), reaction with Cu^{2+} (Cu-complexes).

B) Practical Part:

Selected experiments on the above topics.

APPLIED PHARMACOGNOSY:

A) Theoretical Part.

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- Traditional medicine and medicinal plants : traditional medicine and Methods utilized in traditional medicine. herbal medicine, virtues and shortcomings the scientific basis of herbal medicine, treatment of: constipation, asthma, inflammation and peptic ulcer, therapeutic effects of ginseng.
- Ecologic factors that affect the activity of medicinal plants.
- Synergism and antagonism in the pharmacology of medicinal plants.
- Mycotoxins (aflatoxins, ochratoxins and patulin) .
- Renewed interest in some old remedies.
- Molecular technology, the use of recombinant DNA in Pharmacy.
- Biogenesis of secondary metabolites : basic metabolic pathways and their relationship to secondary metabolism, secondary metabolic pathways: (Shikimic acid, metalogic acid and acetate pathway, biogenesis of amino acids, alkaloids and steroidal compounds).

- Plant tissue culture :

Basic principles of plant tissue culture, techniques, callus culture, cells culture, organ culture, meristem culture, protoplast culture, biotransformation using cell culture, cryopreservation of germplasm, plant cell immobilization.

- Characterization and structure elucidation of natural products:

Physical properties, chromatographic data (GC, HPLC. Ion exchange), determination of molecular formula, spectroscopic data (UV, IR, mass and NMR).

- Methods of Pharmacognosy used in quality control:

Droplet Counter Current Chromatography.

Ash value .

Moisture Content .

Radio Immunoassay .

Derivatization in HPLC.

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B) Practical Part:

- Field and laboratory work to provide a preliminary phytochemical study of medicinal plants utilized in herbal medicine. Students are requested to:
- Collect some medicinal plants used locally in traditional medicine.
- Prepare herbarium specimens.
- Prepare a literature review.
- Prepare powdered plant material.
- Test for some plant constituent: (viz. alkaloids, glycosides, sterols, volatile oils, carbohydrates tannins Etc.).

INDUSTRIAL PHARMACY:

A) Theoretical Part:

- Introduction.
- General aspects of plant design .
- Air and water supply.
- Materials of plant constructions.
- pharmaceutical packing.
- Safety measures.
- G.M.P. regulations .

study of representative machinery and a general idea of the theoretical background of the following units operations :

- a - size reduction and size enlargement.
- b- heat transfer .
- c- evaporation and distillation.
- d- centrifugation .
- e-extraction .
- f-drying .
- g-crystallization .
- h-filtration.
- i- mixing .
- J- humidity control .

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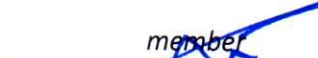
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Unit processes : (including flow. Charts, operation units, and GMP requirements) .

o- Tableting, Suppositories, Semisolid products.

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Practical Part:

The testing of medicinal tablets :

- a- Official tests drug content uniformity, variation test, dissolution test, and disintegration tests of tablets and enteric-coated tablets .
- b- Unofficial tests (hardness, friability) .
- c- Problems raised during tablet manufacture, and how to solve them.
- d- Problems on heat transfer.
- e- Preparation of sketch book on selective unit operation machinery.

IV) CLINICAL PHARMACY:

A) Theoretical Part:

- 1-Definitions and concept .
- 2- Medical Terminology (short descriptive notes on the different diseases) .
3. Prescription drugs used to treat diseases of cardiovascular system: angina pectoris, hypertension coronary and peripheral vasodilators, diuretics, antiarrhythmic, cholesterol regulating agents, antihyperlipidemic, anticoagulants, blood substitutes, myocardial infarction, and congestive heart failure.
- 4- Drugs used to treat hormonal disturbances: insulin and oral hypoglycemic.
5. Treatment of respiratory disease (asthma, bronchitis and emphysema), T.B .
- 6- Drugs used to treat peptic ulcers.
7. Prescription drugs used to treat CNS disorders: epilepsy and Parkinsonism.
8. Treatment of renal diseases and liver diseases.
9. Prescription drugs used to treat some infectious diseases.
- 10- Interpretation of medicinal laboratory analysis.
- 11- TPN and I.V admixture administration.
- 12- Drug Interactions:

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B) Practical Part:

Selected Cases on the above topics.

V) HOSPITAL & COMMUNITY PHARMACY PRACTICE:

A) Theoretical Part:

I) Hospital Pharmacy Practice:

The Hospital: Definition, Classification, Organization and Administration. The Hospital Pharmacy Administration .

Minimum standards of the hospital pharmacy department:

- a- organization b-policy C- facilities
- d- Personnel e-responsibilities
- f- Pharmacy and Therapeutic Committee .

II) Community Pharmacy Practice .

1 - Pharmaceutical care.

The Practice and Managing the Community Pharmacy .

OTC Drugs .

a- Introduction :

- FDA and OTC Drugs .
- Clinical functions of the Pharmacist .

b- Non-prescription Drugs .

- For treatment of conditions and disturbances of the GIT : Ulcer healing drugs Antispasmodics, Antacids, Antidiarrheal, Laxatives, Emetics, Antiemetic's.
- For treatment of pain anesthetics, analgesics
- For treatment of worm infection .
- For treatment of insomnia .
- For treatment of acne, athelot's foot, eczema, nappy rash, psoriasis .
- For treatment of allergy, common cold, coughs, sore throat.
- For treatment of hemorrhoids .
- For treatment of colic, cystitis.

Practical Part

Selected experiments on the above topics.

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