DETAILS OF COURSES FOR PHARM-D
SEMESTER SYSTEM

FIRST PROFESSIONAL

FIRST SEMESTER

Chem-103 PHARMACEUTICAL CHEMISTRY-IA (Organic) 4(3-1)

THEORY

NOTE: The topics will be taught with special reference to their Pharmaceutical Applications.

1. **BASIC CONCEPTS:** Chemical Bonding and concept of Hybridization, Conjugation, Resonance (Mesomerism), Hyperconjugation, Aromaticity, Inductive effect, Electromeric effect, Hydrogen bonding, Steric effect, Effect of structure on reactivity of compounds, Tautomerism of Carbonyl Compounds, Nomenclature of Organic Compounds.

2. **STEREOCHEMISTRY/ CONFORMATIONAL ANALYSIS:** Stereoisomerism, optical isomerism; Molecules with more than one chiral center, Geometrical isomerism, Resolution of racemic mixture, Conformational analysis.

3. **GENERAL METHODS OF PREPARATION, PROPERTIES, IDENTIFICATION TEST AND PHARMACEUTICAL APPLICATIONS OF THE FOLLOWING CLASSES AND THEIR ANALOGUES:**
   i. Alkane, Alkenes, Alkynes, Aromatic compounds
   ii. Alkyl halide, Alcohol, phenols, ethers, amines
   iii. Ketones, Aldehydes
   iv. Acids, Esters, Amides and derivatives

4. **NUCLEOPHILIC, ELECTROPHILIC SUBSTITUTION REACTION IN ALIPHATIC AND AROMATIC SYSTEMS:**

5. **ORIENTATION IN ELECTROPHILIC SUBSTITUTION REACTIONS ON BENZENE RING:**

PRACTICAL

Hazards in the chemistry laboratory, hazards from dangerous chemicals (corrosive and toxic chemicals, carcinogens, explosive and flammable chemicals). Good laboratory practices. Organic analysis: Identification of unknown simple organic compounds. Identification of functional groups; Carboxylic, hydroxyl, amino and nitro groups by wet organic analysis.

RECOMMENDED BOOKS

Biochem-105          PHARMACEUTICAL CHEMISTRY IIA (Biochemistry)        4(3-1)

THEORY

1. **GENERAL INTRODUCTION AND BASIC BIOCHEMICAL PRINCIPLES:**

2. **BASIC CHEMISTRY OF BIOMOLECULES:** (Nature, Classification etc.)
   a) **Carbohydrates:** Chemistry, Classification, Reactions of Carbohydrates, Optical activity, Biological and pharmaceutical importance of carbohydrates.
   b) **Lipids:** Chemistry of Fatty acids and Lipids, Classification (Saponifiable and non-saponifiable lipids, Simple, Complex and Derived lipids), Reactions of Fatty acids and other Lipids, Essential fatty acids, Biological and pharmaceutical importance of lipids.
   c) **Proteins and Amino acids:** Chemistry, Classification of proteins and amino acids, Reactions of proteins and amino acids, Organizational levels, Macromolecular nature of proteins, Biological and pharmaceutical importance of proteins and amino acids.
   d) **Nucleic Acids:** Chemistry, Types (DNA, RNA, mRNA, tRNA, rRNA), Purine and Pyrimidine bases, Nucelosides, Nucelotides, Structures of nucleic acids, Biological and pharmaceutical importance of nucleic acids.
   e) **Vitamins:** Chemistry, Classification (Fat-soluble and water-soluble vitamins), Biological and pharmaceutical importance of vitamins.
   f) **Hormones:** Chemistry, Classification (Proteinous and nonproteinous hormones, amino acid derivatives, steroids), Biological and pharmaceutical importance of hormones.
   g) **Enzymes:** Chemistry, Classification, Mode of action, Kinetics (Michaelis Menten Equation and some modifications), Inhibition, Activation, Specificity, Allosteric enzymes, Factors affecting the rate of an enzyme-catalyzed reaction, Biological and pharmaceutical importance, Mechanism of action of some important enzymes (Chymotrypsin, Ribonuclease).

PRACTICAL

Hazards and safety in the clinical biochemistry laboratory. Qualitative analysis of: Carbohydrates, amino acids, peptides and proteins, lipids and sterols (cholesterol), bile salts and bilirubin. Analysis of normal and abnormal components of urine including sugar, uric acid, bilirubin, urea and creatinine.

RECOMMENDED BOOKS

1. **PHARMACY ORIENTATION:**
   Introduction and orientation to the Profession of Pharmacy in relation to Hospital Pharmacy, Retail Pharmacy, Industrial Pharmacy, Forensic Pharmacy, Pharmaceutical education and research etc.

2. **HISTORY AND LITERATURE OF PHARMACY:**
   a. A survey of the history of pharmacy through ancient Greek and Arab periods with special reference to contribution of Muslim scientists to pharmacy and allied sciences.
   b. An introduction of various official books.

3. **PHYSICO-CHEMICAL PRINCIPLES:**
   a. **Solutions:** Introduction, types, concentration expressions, ideal and real solution, colligative properties, their mathematical derivations and applications in pharmacy, molecular weight determinations, distribution co-efficient and its applications in pharmacy.
   b. **Solubilization:** Factors affecting solubility. Surfactants, their properties and types. Micelles; their formulation and types.
   c. **Adsorption:** Techniques and processes of adsorption in detail.
   d. **Ionization:** pH, pH indicators, pKa, buffers, buffer’s equation, isotonic solutions and their applications in pharmacy.
   e. **Hydrolysis:** Types and protection of drugs against hydrolysis.
   f. **Micromeritics:** Particle size, shapes and distribution of particles. Methods of determination of particle size and importance of particle size in Pharmacy.

4. **DISPERSSIONS:**
   a. **Colloids:** Types, methods of preparation, properties (optional, kinetic, electrical). Dialysis and artificial kidney, stability of colloids, protection and sensitization phenomenon and application of colloids in Pharmacy.
   b. **Emulsions:** Types, theories of emulsification, emulsifying agents their classification and stability of emulsion.

**PRACTICAL**
Experiments to demonstrate some of the physico-chemical processes like simple distillation, steam distillation, crystallization, sublimation, centrifugation and dialysis. Determination of particle size and shape, preparation of buffer solutions and isotonic solutions. Determination of pH. Determination of refractive index of various solvents such as: Ethanol, methanol, acetone, polyethylene glycol, hexane and
mineral oils etc. Acid-base titrations: Sulfuric acid, hydrochloric acid, bicarbonate, sodium hydroxide, Sodium bicarbonate etc. Determination of the density and specific gravity of different solvents.

RECOMMENDED BOOKS


THEORY

1. BASIC CELL FUNCTIONS:
   b. Cell structure: Microscopic Observation of Cell, Microscopic, Cell Organelles, Cytoskeleton.
   c. Protein activity and cellular metabolism: Binding Site Characteristics, Regulation of Binding site Characteristics, Chemical Reactions, Enzymes, Regulation of Enzyme Mediated Reactions, Multienzyme metabolic Pathways, ATP, Cellular Energy Transfer, Carbohydrate, Fat, and Protein Metabolism, Essential Nutrients.
   d. Genetic information and Protein Synthesis: Genetic Code, Protein Synthesis, Protein, Degradation, Protein Secretion, Replication and Expression of Genetic Information, Cancer, Genetic Engineering.

2. BIOLOGICAL CONTROL SYSTEM:


Consciousness and Behavior: State of consciousness, conscious Experiences, Motivation and Emotion, Altered State of Consciousness, Learning and Memory, Cerebral Dominance and language Conclusion.

PRACTICAL


RECOMMENDED BOOKS


ANATOMY 3(3-0)

THEORY


RECOMMENDED BOOKS


THEORY


PRACTICAL

Demonstration of preparation and staining of tissue sections. Demonstration of electron micrographs of cell and its component. Identification of microscopic sections of epithelium, connective and supportive tissues, nervous tissues, nervous system.

RECOMMENDED BOOKS


THEORY

Basics of Grammar: Parts of speech and use of articles. Sentence structure, active and passive voice; Practice in unified sentence. Analysis of phrase, clause and sentence structure. Transitive and intransitive verbs, punctuation and spelling.

Comprehension: Answers to questions on a given text.

Discussion: General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students).

Listening: Improve listening skills by showing documentaries/films carefully selected by subject teacher.

Translation skills: Urdu to English.

Paragraph writing: Topics to be chosen at the discretion of the teacher.

Presentation skills: Introduction & practice to improve presentation skills.

NOTE: Extensive reading is required for vocabulary building.
SECOND SEMESTER

Chem-105  PHARMACEUTICAL CHEMISTRY-IB (Organic)  4(3-1)

THEORY

Note: The topics will be taught with special reference to their pharmaceutical applications.

1. **HETEROCYCLIC CHEMISTRY:**
   i. Preparation and properties of medicinally important Heterocyclic Compounds such as pyrol, furan, thiophene, pyridine, pyrimidine and pyrazine.
   ii. Preparation and properties of heterocyclic compounds in which benzo-ring is fused with five and six membered ring containing one hetero atom; Indole, Quinoline and Isoquinoline.

2. **REACTION MECHANISM:**
   - **Organic Reaction Mechanism:** Arndt-Eistert reaction, Baeyer-Villiger oxidation, Diels Alder reaction; Grignard’s reaction, Metal Hydride reduction and Wolff Kishner reduction, Friedel Craft’s reaction, Perkin reaction, Cannizzaro’s reaction, Mannich reaction.

3. **REACTIVE INTERMEDIATE AND FREE RADICALS:**
   - **Introduction:** Generation, stability and Reaction of the following Intermediates; Carbocations, Carbanions, Carbenes, Nitrenes, Benzynes.
   - **Type of reactions:** An Overview.
   - **Free radicals:** Free radical scavengers and their applications.

4. **CARBONIUM ION REARRANGEMENTS:**
   - Pinacol-Pinacolone, Wagner-Meerwein, Wolff, Hofmann and Beckmann rearrangements.

5. **CARBANIONS:**
   - Condensation reaction (Aldol condensation, Favorskii rearrangement, Wittig rearrangement).

PRACTICAL

Estimation of functional groups; Carboxylic, hydroxy, amino and nitro groups; determination of molecular weights of organic compounds. Organic preparations like benzoic acid, aspirin, acetonilide, iodoform, nitrophenol, 3-nitrophthalic acid, benzhydrol, 2, 4-dinitro-chlorobenzene.

RECOMMENDED BOOKS

THEORY

1. **METABOLIC FATE OF BIOMOLECULES (Anabolism and Catabolism):**
   a. **Carbohydrates:** Brief introduction to the digestion and absorption of carbohydrates, Aerobic and anaerobic breakdown of Glucose, Glycolysis, Pentose Phosphate Pathway, Glycogenolysis, Glycogenesis, Gluconeogenesis, Citric acid cycle, Energetics of various metabolic processes.
   b. **Lipids:** Brief introduction to the digestion and absorption of lipids, Oxidation of fatty acids through β-oxidation, Biosynthesis of fatty acids, neutral lipids and cholesterol.
   c. **Proteins and Amino acids:** Brief introduction to the digestion and absorption of proteins and amino acids, Metabolism of essential and non-essential amino acids, Biosynthesis and catabolism of Haemins and porphyrin compounds.
   d. **Bioenergetics:** Principles of bioenergetics, Electron transport chain and oxidative phosphorylation.

2. **REGULATION OF METABOLIC PROCESSES:**
   a. **Role of Vitamins:** Physiological role of Fat-soluble (A, D, E and K) and Water-soluble (Thiamin, Riboflavin, Pantothenic acid, Niacin, Pyridoxal phosphate, Biotin, Folic acid, Cyanocobalamin-members of B-complex family and Ascorbic acid), Coenzymes and their role in the regulation of metabolic processes.
   b. **Receptor Mediated regulation (Hormones):** Mechanism of action of hormones, Physiological roles of various hormones, Site of synthesis and target sites of hormones.
   c. **Secondary Messengers:** Role of cAMP, Calcium ions and phosphoinositol in the regulation of metabolic processes.
   d. **Gene Expression:** Replication, Transcription and Translation (Gene expression) Introduction to Biotechnology and Genetic Engineering, Basic principles of Recombinant DNA technology, Pharmaceutical applications, Balance of Catabolic, Anabolic and Amphibolic processes in human metabolism, Acid-Base and Electrolyte Balance in Human body.

3. **INTRODUCTION TO CLINICAL CHEMISTRY:**
   Introduction and importance of the clinical chemistry. Laboratory tests in diagnosis of diseases including Uric acid, Cholesterol, Billirubin and Creatinine.

**PRACTICAL**

Estimation of glucose, total proteins and albumin by spectrophotometer, serum minerals, lipid profile (total lipids, triglycerides, total cholesterol, HDL cholesterol, etc.). Clinical enzyme: Alanine amino transferase (ALT), aspartate aminotransferase (AST), lactate dehydrogenmse (LDH), creatine kinase (CK), alkaline phosphatase. Estimation of vitamin A and C. Units and reference values.

**RECOMMENDED BOOKS**

THEORY

1. **RHEOLOGY:** Definition and Fundamental concept; Properties contributing to Rheological behaviour; Graphic presentation of Rheological data.

2. **PHYSICOCHEMICAL PROCESSES:**
   a. **Precipitation:** Process of precipitation and its applications in Pharmacy.
   b. **Crystallization:** Types of crystals, Mechanism and methods of crystallization and its applications in Pharmacy.
   c. **Distillation:** Simple distillation, fractional distillation, steam distillation, vacuum distillation, destructive distillation and their applications in Pharmacy.
   d. **Miscellaneous Processes:** Efflorescence, deliquescence, lyophilization, elutrition, exiccation, ignition, sublimation, fusion, calcination, adsorption, decantation, evaporation, vaporization, centrifugation, dessication, levigation and trituration.

3. **EXTRACTION PROCESSES:**
   (i) **Maceration:** Purpose & process.
   (ii) **Percolation:** Purpose and Process.
   (iii) **Liquid-Liquid extraction:** Purpose and Process.
   (iv) **Large scale extraction:** Purpose and Process.

4. **RATE AND ORDER OF REACTIONS:**

5. **KINETIC PRINCIPLES AND STABILITY TESTING:**
   **THEORETIC CONSIDERATIONS:** Degradation:
   b. **Chemical Factors:** Complex chemical reactions, Oxidation-reduction reactions, Hydrolysis.

PRACTICAL


RECOMMENDED BOOKS


Pharm-D-104

PHYSIOLOGY-B

4(3-1)

THEORY

Coordinated Body Functions:


d. The Digestion and Absorption of Food (Overview): Functions of the Gastrointestinal Organs, Structure of the Gastrointestinal Tract Wall, Digestion and Absorption, Regulation of Gastrointestinal Processes, Pathophysiology of the Gastrointestinal Tract.


**PRACTICAL**

Blood: Determination of hemoglobin (Hb), ESR, RBC Count, WBC count, DLC (Differential leukocyte count), bleeding time, coagulation time and determination of blood groups. Respiration: Estimation of vital capacity and its relation to posture and standard vital capacity. Determination of tidal volume, demonstration of artificial respiration. CVS: Recording of arterial pulse, recording of arterial blood pressure and Electro-cardiogram.

**RECOMMENDED BOOKS**


**Eng-103** ENGLISH-B (Communication and Writing Skills) 4(4-0)

*Paragraph writing:* Practice in writing a good, unified and coherent paragraph.

*CV and job application:* Translation skills: Urdu to English.

*Study skills:* Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension.

*Academic writing skills:* Letter/memo writing, minutes of meetings, use of library and internet. How to write a proposal for research paper/term paper? (emphasis on style, content, language, form, clarity, consistency).

*Presentation skills:* Personality development (special emphasis on content, confidence, eye contact, style and pronunciation).

*Essay writing:* Descriptive, narrative, discursive, argumentative.


**NOTE:** Documentaries to be shown for discussion and review. Extensive reading is required for vocabulary building.
SECOND PROFESSIONAL
THIRD SEMESTER

Pharm-D-201 PHARMACEUTICS-IIA (Dosage Form Science) 4(3-1)

THEORY


2. **INTRODUCTION:** Dosage form, Ingredient, Product formulation.

3. **GALENICAL PREPARATIONS:** Infusions, Decoctions, Extracts, Fluid extracts, Tinctures, Aromatic waters.

4. **SOLVENTS USED IN PHARMACEUTICAL PREPARATIONS:**


6. **ORAL SUSPENSIONS, EMULSIONS, MAGMA AND GELS:** Preparations, examples and importance.


PRACTICAL


RECOMMENDED BOOKS

THEORY

1. GENERAL PHARMACOLOGY:
   a) **Pharmacology**: Definition of Pharmacology, history and its various branches. Definition of Drug and its various sources.
   b) **Routes of drug administration, advantages and disadvantages**.
   c) **Pharmacokinetics**: Drug solubility and passage of drug across the biological membranes. Absorption, distribution, metabolism and elimination of drugs and factors affecting them. Various pharmacokinetic parameters including volume of distribution (Vd), clearance (Cl), Biological half life (t\(_{1/2}\beta\)), Bioavailability and various factors affecting it. Dose, Efficacy and Potency of drugs. Hypersensitivity and Idiosyncratic reactions, drug tolerance and dependence. Drug interactions. Plasma protein binding.
   d) **Pharmacodynamics**: How drugs act? Receptors and their various types with special reference to their molecular structures. Cell surface receptors, signal transduction by cell surface receptors, signaling Mediated by intra cellular receptors, target cell and hyper sensitization, Pharmacological effects not Mediated by receptors (for example anesthetics and cathartics) Ion channel, enzymes, carrier proteins, Drug receptor interactions and theories of drug action. Agonist, antagonist, partial agonist, inverse agonist. Receptors internalization and receptors co-localization. Physiological Antagonism, Pharmacological Antagonism (competitive and non-competitive), Neutralization Antagonism, Neurotransmission and neuro-modulation. Specificity of drug action and factors modifying the action & dosage of drugs. Median lethal dose (LD:50), Median effective dose (ED:50) and Therapeutic Index, Dose-response relationships.

2. DRUGS ACTING ON AUTONOMIC NERVOUS SYSTEM (ANS):
   a. Organization of ANS its subdivisions and innervations.
   b. Neurotransmitters in ANS, their synthesis, release and fate.
   c. Sympathetic agonists: Catecholamines and Noncatecholamines.
   e. Parasympathetic (Cholinergic) agonists and cholinesterase enzyme inhibitors (anticholinesterases) Parasympathetic antagonists.
   f. Ganglion stimulants and Ganglion blockers
   g. Neuromuscular Blockers

3. DRUGS ACTING ON GASTROINTESTINAL TRACT:
   a. Emetic and anti-emetics
   b. Purgatives
   c. Anti-diarrheal agents
d. Treatment of Peptic & duodenal ulcer: Antacids, H₂-Receptor antagonists, antimuscarinic agents, proton pump inhibitors, prostaglandin antagonists, gastrin receptor antagonist and cytoprotective agents

e. Drug treatment of chronic inflammatory bowel diseases

f. Drugs affecting bile flow and Cholelithiasis

PRACTICAL
Preparation of standard solution. Ringer solution. Tyrode solution. Kreb solution. Normal saline solution. To demonstrate the effects of sympathomimetic (Adrenaline) & sympatholytic drugs (propranolol) on frog/rabbit’s heart. To demonstrate the effects of parasympathomimetic (acetylcholine) and parasympatholytic (atropine) drugs on frog’s/rabbit’s heart. To demonstrate the effects of an unknown drug on frog’s/rabbit’s heart. Routes of administration of drugs. Rabbit intestine assay.

RECOMMENDED BOOKS

Pharm-D-203 PHARMACOGNOSY-IA (Basic) 4(3-1)

THEORY

1. GENERAL INTRODUCTION: Historical development and scope of Pharmacognosy. Terminology used in Pharmacognosy. An introduction of traditional systems (Unani, Ayurvedic and Homoeopathic systems of medicine) with special reference to medicinal plants. Introduction to herbal pharmacopoeia and modern concepts about Pharmacognosy.


3. THE STUDY OF THE CRUDE DRUGS BELONGING TO VARIOUS FAMILIES OF MEDICINAL IMPORTANCE

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Families</th>
<th>Crude Drugs</th>
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<tbody>
<tr>
<td>a.</td>
<td>Ranunculaceae</td>
<td>Aconitum, Larkspur, Pulsatilla, Hydrastis</td>
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<tr>
<td>b.</td>
<td>Papaveraceae</td>
<td>Papaver somniferum, Sanguinaria, Canadensis</td>
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<td>c.</td>
<td>Leguminosae</td>
<td>Acacia, Glycyrrhiza, Senna, Cassia, Tamarind</td>
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<tr>
<td>d.</td>
<td>Umbelliferae</td>
<td>Fennel, Carum, Coriander, Conium, Asafoetida</td>
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<tr>
<td>e.</td>
<td>Apocynaceae</td>
<td>Rauwolfia, Catharanthus</td>
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<tr>
<td>f.</td>
<td>Asclepiadaceae</td>
<td>Gymnema sylvestre, Calotrops gigantea</td>
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4. **EVALUATION AND ADULTRATION OF CRUDE DRUGS:** Evaluation of crude drugs i.e., Organoleptic, Microscopic, Physical, Chemical and Biological. Deterioration and Adulteration of crude drugs. Types of adulteration, inferiority, spoilage, admixture, sophistication and substitution of crude drugs.

**PRACTICAL**

Introduction of the entire and broken parts of the plant drugs. Microscopic and organoleptic evaluation of crude drugs: Opium, coriander, fennel, ginger, acacia, tragacanth, curcuma, peppermint, bee wax anise, star anise, caraway, glycrrhiza, senna, cinchona, clove, cinnamon, aloe, rubarb, nux vomica.

**RECOMMENDED BOOKS**


**Micro-413 PHARMACEUTICS-III (Pharmaceutical Microbiology and Immunology) 4(3-1)**

**THEORY**

Note: The topics will be taught with special reference to their pharmaceutical applications.


2. **MICRO-ORGANISMS:**
   b) **The Viruses:** Introduction, Classification (and detail of at least one species from every group), cultivation and replication.
   c) **The Fungi/Yeast/Molds:**
   d) **The Protozoa:**

3. **THE NORMAL FLORA:**
   a) Microbiology of air, water and soil (general introduction and normal inhabitants of air, water and soil).
   b) Normal flora of Skin, Intestinal tract, Ear, Nose etc.
PRACTICAL


RECOMMENDED BOOKS


IS-201 ISLAMIC STUDIES 3(3-0)

1. INTRODUCTION TO QURANIC STUDIES:
   1. Basic Concepts of Quran
   2. History of Quran
   3. Uloom-ul-Quran

2. STUDY OF SELECTED TEXT OF HOLLY QURAN:
   4. Verses of Surah al-Furqan Related to Social Ethics (Verse No. 63-77).
   5. Verses of Surah Al-Inam Related to Ihkam (Verse No. 152-154).

3. STUDY OF SELECTED TEXT OF HOLLY QURAN:
   1. Verses of Surah Al-Ihzab Related to Adab-al-Nabi (Verse No. 6, 21, 40, 56, 57, 58).
   2. Verses of Surah Al-Hashar (18, 19, 20) Related to thinking, Day of Judgment.
   3. Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No. 1, 14).

4. SEERAT OF HOLY PROPHET (S.A.W) I:
   1. Life of Muhammad Bin Abdullah ( Before Prophet Hood)
   2. Life of Holy Prophet (S.A.W.) in Makkah
   3. Important Lessons Derived from the life of Holy Prophet (S.A.W.) in Makkah

5. SEERAT OF HOLY PROPHET (S.A.W) II:
   1. Life of Holy Prophet (S.A.W.) in Madina
   2. Important Events of Life Holy Prophet (S.A.W.) in Madina
   3. Important Lessons Derived from the life of Holy Prophet (S.A.W.) in Madina
6. **INTRODUCTION TO SUNNAH:**
   1. Basic Concepts of Hadith
   2. History of Hadith
   3. Kinds of Hadith
   4. Uloom –ul-Hadith
   5. Sunnah & Hadith
   6. Legal Position of Sunnah

7. **SELECTED STUDY FROM TEXT OF HADITH:**

8. **INTRODUCTION TO ISLAMIC LAW & JURISPRUDENCE:**
   1. Basic Concepts of Islamic Law & Jurisprudence
   2. History & Importance of Islamic Law & Jurisprudence
   3. Sources of Islamic Law & Jurisprudence
   4. Nature of Differences in Islamic Law
   5. Islam and Sectarianism

9. **ISLAMIC CULTURE & CIVILIZATION:**
   1. Basic Concepts of Islamic Culture & Civilization
   2. Historical Development of Islamic Culture & Civilization
   3. Characteristics of Islamic Culture & Civilization
   4. Islamic Culture & Civilization and Contemporary Issues

10. **ISLAM & SCIENCE:**
    1. Basic Concepts of Islam & Science
    2. Contributions of Muslims in the Development of Science
    3. Quranic & Science

11. **ISLAMIC ECONOMIC SYSTEM:**
    1. Basic Concepts of Islamic Economic System
    2. Means of Distribution of wealth in Islamic Economics
    3. Islamic Concept of Riba
    4. Islamic Ways of Trade & Commerce

12. **POLITICAL SYSTEM OF ISLAM:**
    1. Basic Concepts of Islamic Political System
    2. Islamic Concept of Sovereignty
    3. Basic Institutions of Govt. in Islam

13. **ISLAMIC HISTORY:**
    1. Period of Khlaft-E-Rashida
    2. Period of Ummayyads
    3. Period of Abbasids

14. **SOCIAL SYSTEM OF ISLAM:**
    1. Basic Concepts of Social System of Islam
    2. Elements of Family
    3. Ethical Values of Islam
THEORY

1. **ALGEBRA:**
   (a) Solution of Linear and Quadratic Equations. Equations reducible to Quadratic Form. Solution of simultaneous Equations.
   (b) Arithmetic, Geometric and Harmonic Progressions: Arithmetic, Geometric and Harmonic Means.
   (c) Permutations and Combinations:
   (d) Binomial Theorem: Simple application.

2. **TRIGONOMETRY:** Measurement of angles in Radian and Degrees. Definitions of circular functions. Derivation of circular function for simple cases.

3. **ANALYTICAL GEOMETRY:** Coordinates of point in a plane. Distance between two points in a plane. Locus, Equations of straight line, Equation of Parabola, Circle and Ellips.


5. **INTEGRAL CALCULUS:** Concept of integration Rules of integration. Integration of algebraic, exponential, logarithmic and trigonometric functions by using different techniques, and numerical integration.

RECOMMENDED BOOKS


FOURTH SEMESTER

Pharm-D-204 PHARMACEUTICS-IIB (Dosage Form Science)

4. **INTRODUCTION TO PARENTERALS:** Official types of injections, solvents and vehicles for injections, added substances.

5. **A BRIEF INTRODUCTION TO ORAL HYGIENE PRODUCTS:**

**PRACTICAL**

Preparation of methyl salicylate ointment, sulphur ointment, zinc oxide ointment, iodine ointment, red iodide of mercury lotion, calamine lotion, iodine tincture, ferrous sulfate tincture, tincture benzoin co, liniment terpentine. Preparations of oral hygiene products e.g., mouth wash, poultice of kaolin, effervescent granules. Preparations of oral hygiene products e.g., mouth wash, poultice of kaolin, effervescent granules e.g. ENO, calc, distilled water for injections. To appear or reject the given batch of tablets during in process quality control. Preparation of aromatic ammonium spirit, effervescent granules, kaoline poultics, calamine lotion, castor oil emulsion.

**RECOMMENDED BOOKS**


Pharm-D-206 PHARMACOLOGY & THERAPEUTICS-IB 4(3-1)

**THEORY**

1. **AUTACOIDS AND THEIR ANTAGONISTS:** Histamine and anti-histamines, serotonin and serotonin antagonist, prostaglandins and their antagonists.

2. **DRUGS ACTING ON RESPIRATORY SYSTEM:**
   a. Drugs used in cough (Anti-tussives, Expectorants and Mucolytic agents).
   b. Drugs used in Bronchial Asthma. Bronchodilators: Sympathomimetic, Xanthine derivatives, Leukotriene receptor antagonists and synthesis inhibitors, Muscarinic receptor antagonists, Cromoglycate, Nedocromil, Cortecosteroids & other Anti-inflammatory drugs.

3. **DRUGS ACTING ON CARDIO-VASCULAR SYSTEM:**
   a. Angina pectoris and its drug treatment
   c. Anti-arrhythmic drugs
   d. Anti-hyperlipidemic.
4. **DRUGS ACTING ON GENITOURINARY SYSTEM:** Oxytocin, Ergot alkaloids and uterine relaxants.

5. **ANTI-ANAEMIC DRUGS:**

6. **HORMONES, ANTAGONISTS AND OTHER AGENTS AFFECTING ENDOCRINE FUNCTION:** Endocrine function and dysfunctions. Drug used for therapy of Diabetes Mellitus: Insulin and Oral Hypoglycemic agents, Corticosteroids, Thyroid hormone and anti-thyroid drugs.

**PRACTICAL**

To demonstrate the effects of vasoconstrictor drugs on frog’s blood vessels. To demonstrate the effects of stimulant drugs on rabbit’s intestine (acetyl choline, barium chloride). To demonstrate the effects of depressant drugs on rabbit’s intestine (atropine). To differentiate the effect of an unknown drug on rabbit’s intestine and identify the (unknown) drug. To study the effects of adrenaline on rabbit’s eyes. To study the effects of local anaesthetic drug (e.g. cocaine) on Rabbit’s Eyes. To identify the unknown drug & differentiate its effects on Rabbit’s eyes.

**RECOMMENDED BOOKS**


**THEORY**

1. **DRUGS OF ANIMAL ORIGIN:** General introduction and discussion about honey, gelatin, shellac, musk, civet, ambergris, cod liver oil, cantharides and spermaceti.

2. **BIOLOGICS:** Sources, structure, preparation, description and uses of vaccines, toxins, antitoxins, venoms, antivenoms, antiserums.
3. **SURGICAL DRESSINGS:** Classification of fibers as vegetable, animals and synthetic fibers. Evaluation of fibers in surgical dressings, BPC standards for dressings and sutures. Discussion on cotton, wool, cellulose, rayon, catgut and nylon.

4. **PESTICIDES:** Introduction, methods and control of pests with special reference to pyrethrum, tobacco, and other natural pesticides.

5. **GROWTH REGULATORS:** General account with special reference to plant hormones; Auxins, Gibberellins, Abscisic acid and Cytokinins.

6. **POISONOUS PLANTS INCLUDING ALLERGENS AND ALLERGENIC PREPARATIONS:** General introduction, case history, skin test, treatment of allergy, inhalant, ingestant, injectant, contactant, infectant and infestant allergens. Mechanism of allergy.


**PRACTICAL**

Microscopic examination of powders and selections of plant drugs. Microscopic study of commercial fibers (cotton, silk, wool fibers etc.). Microscopic study of commercial starches (wheat starch, rice starch, maize starch). Microscopic study of powders cinchona, cinnamon, stramonium, senna leaf powder, liquorice powder. A study tour will be an integral part of the syllabus and will be arranged at the end of the session for collection of medicinal plants from various hilly areas of the country.

**RECOMMENDED BOOKS**


**Micro-414 PHARMACEUTICS-IIIB (Pharmaceutical Microbiology and Immunology)** 4(3-1)

**THEORY**

Note: The topics will be taught with special reference to their pharmaceutical applications.


3. **FACTORY & HOSPITAL HYGIENE including GOOD MANUFACTURING PRACTICES:**

4. **INTRODUCTION TO DISEASES:** Dengue fever, Bird flu, SARS, or other prevailing diseases of bacteria and virus.

**PRACTICAL**

Sterilization of glassware and pharmaceutical products by various methods. Microbiological assays of antibiotics and vitamins.

**RECOMMENDED BOOKS**


**SSH-201 PAKISTAN STUDIES 2(2-0)**

**THEORY**

**Introduction/Objectives:**
- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

1. **HISTORICAL PERSPECTIVE:**
   a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Dr. Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
   b. Factors leading to Muslim separatism
   c. People and Land
      i. Indus Civilization
      ii. Muslim advent
      iii. Location and geo-physical features

2. **GOVERNMENT AND POLITICS IN PAKISTAN:**
   Political and constitutional phases:
   a. 1947-58
   b. 1958-71
   c. 1971-77
   d. 1977-88
   e. 1988-99
   f. 1999-onward
3. **CONTEMPORARY PAKISTAN:**
   a. Economic institutions and issues
   b. Society and social structure
   c. Ethnicity
   d. Foreign policy of Pakistan and challenges
   e. Futuristic outlook of Pakistan

**RECOMMENDED BOOKS**


Stat-101 PHARMACY PRACTICE-IB (Biostatistics) 4(4-0)

**THEORY**


2. **ORGANIZING and DISPLAYING DATA:** Variables, Quantitative and Qualitative Variables, Univariate Data, Bivariate Data, Random Variables, Frequency Table, Diagrams, Pictograms, Simple Bar Charts, Multiple Bar Charts, Histograms.

3. **SUMMARIZING DATA and VARIATION:** The Mean, the Median, the Mode, the Mean Deviation, the Variance and Standard Deviation, Coefficient of Variation.

4. **CURVE FITTING:** Fitting a Straight Line. Fitting of Parabolic or High Degree Curve.

5. **PROBABILITY:** Definitions, Probability Rules, Probability Distributions (Binomial & Normal Distributions).

6. **SIMPLE REGRESSION AND CORRELATION:** Introduction. Simple Linear Regression Model. Correlation co-efficient.

7. **TEST OF HYPOTHESIS AND SIGNIFICANCE:** Statistical Hypothesis. Level of Significance. Test of Significance. Confidence Intervals, Test involving Binomial and Normal Distributions.

8. **STUDENT “t”, “F” and Chi-Square Distributions:** Test of Significance based on “t”, “F” and Chi-Square distributions.
9. **ANALYSIS OF VARIANCE:** One-way Classification, Two-way Classification, Partitioning of Sum of Squares and Degrees of Freedom, Multiple Compression Tests such as LSD, The analysis of Variance Models.

10. **STATISTICAL PACKAGE:** An understanding of data analysis by using different statistical tests using various statistical software’s like SPSS, Minitab, Statistica etc.

**RECOMMENDED BOOKS**


**THIRD PROFESSIONAL**

**FIFTH SEMESTER**

PATH-302 PATHOLOGY 4(3-1)

**THEORY**

1. **SCOPE OF PATHOLOGY & CONCEPT OF DISEASES:**

2. **DEFINITION AND TERMINOLOGY:** Ischemia, Hypoxia, Necrosis, Infarction, Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Aplasia, Anaplasia.

3. **RESPONSE OF BODY TO INJURY AND INFECTION:** Acute and Chronic inflammation, Immunity, Allergy, Hyper Sensitivity.

4. **SPECIFIC DISEASES:** Ulcer (Peptic, Duodenal), Hypertension, Leukemia or Blood Cancer (Malignant Carcinoma, Sarcoma & Lymphomas), Diagnosis and treatment of Cancer in general, fate, survival and prognosis with tumors.

**PRACTICAL**

Introduction to pathology lab, proficiency to recognize and describe gross lesions and histopathological changes, techniques for tissue processing for histopathological examination, staining procedures, special staining techniques, Microscopically orientation of basic cellular changes, slides of inflammatory changes, circulatory disturbances and tumors.

**RECOMMENDED BOOKS**


**THEORY**

1. **DRUGS ACTING ON CENTRAL NERVOUS SYSTEM:**
   a. Sedatives & Hypnotic
   b. Anxiolytics, antidepressants and antimanic drugs
   c. Antiepileptics
   d. Antiparkinsonian and drug used in other neurodegenerative diseases.
   e. Antipsychotics
   f. Opioid analgesics
   g. Therapeutic gases (Oxygen, Carbon-dioxide, Nitric oxide and Helium.
   h. Cerebral Stimulants, Medullary stimulants, Spinal Cord Stimulants.
   i. Anesthetics: General and local

**NON-STEROIDAL ANTI-INFLAMMATORY DRUGS:** Disease modifying drugs, antirheumatic drugs, non-opioid analgesics and drugs used in the treatment of gout.

**PRACTICAL**

To study the convulsant effect of strychnine and picrotoxin in frogs and to determine the site of action. To identify the unknown (convulsant) drug and determine its site of action. To study the effects of adrenaline on human eyes.

Demonstration of gaseous and volatile general anesthesia in laboratory animals. Demonstration of intravenous general anesthesia in laboratory animals. Demonstrations of various local anesthesia such as topical/surface, infiltration, nerve block, para vertebral, and epidural in laboratory animals.

**RECOMMENDED BOOKS**

THEORY

1. **SEPARATION AND ISOLATION OF PLANT CONSTITUENTS**: Introduction and use of spectroscopic and chromatographic techniques for the identification of natural products. Description and interpretation of ultraviolet, infrared, mass, nuclear magnetic resonance (¹H-NMR and ¹³C-NMR) spectra and other advance techniques to elucidate the structure of natural products.

2. **CARBOHYDRATES AND RELATED COMPOUNDS**: Introduction and classification of carbohydrates, sugars as adjuvant in drugs, role of impurities in sugar substances.
   a. Sucrose and Sucrose containing drugs: Sucrose, Dextrose, Liquid glucose, Fructose, Lactose, Xylose, Caramel, Starch, Inulin, Dextrine etc.
   b. Cellulose and Cellulose Derivatives: Powdered cellulose, Microcrystalline cellulose, Methyl cellulose, Sodium Carboxy-methyl cellulose.
   c. Gums and Mucilage: Tragacanth, Acacia, Sodium Alginate, Agar, Pectin.

3. **ALKALOIDS**: Introduction, Properties, Classification, Function of alkaloids in plants, Methods of extraction and identification tests.
   c. Quinoline Alkaloids: Cinchona.
   d. Isoquinoline Alkaloids: Ipecacuanha, Opium.
   e. Indole alkaloids: Rauwolfia, Catharanthus, Nux vomica, Physostigma, Ergot.
   f. Imidazole alkaloids: Pilocarpus.
   g. Steroidal alkaloids: Veratrum.
   h. Alkaloidal amines: Ephedra, Colchicum.
   i. Purine Bases: Tea, Coffee.

4. **GLYCOSIDES**: Introduction, classification, chemistry, extraction, isolation and medicinal uses of:
   a. Cardioactive glycosides: Digitalis, Strophanthus and White squill.
   b. Anthraquinone glycosides: Cascara, Aloe, Rhubarb, Cochineal & Senna.
   c. Saponin glycosides: Glycyrrhiza, Sarsaparilla.
   d. Cyanophore glycosides: Wild cherry.
   e. Isothiocyanate glycosides: Black mustard.
   f. Lactone glycosides: Cantharide.
   g. Aldehyde glycosides: Vanilla.
   h. Miscellaneous glycosides: Gentian, Quassia, Dioscorea.

1. **PLANT STEROIDS**: Introduction, extraction, isolation, nomenclature, sources and uses of bile acids, plant sterols, steroidal sapogenins, steroid hormones, withanolides and ecdysons.

2. **LIPIDS**: Introduction, classification, source, active constituents and pharmacological uses of:
   a. Fixed Oils: Castor oil, cotton seed oil, olive oil, peanut oil, sun flower oil, corn oil, coconut oil, almond oil, linseed oil, mustard oil, sesame oil and soybean oil.
   b. Fats and Related Compounds: Theobroma oil and Lanolin.
   c. Waxes: Bees wax, carnauba wax, spermaceti and Jojoba oil.
PRACTICAL

Extraction of the active constituents of crude drugs and chemical tests for their identification: Extraction and identification of nicotine from tobacco leaves, extraction and identification of tannins from clove and cinnamon, extraction and identification of alkaloids from nux vomica seeds. Identification of resin in rosen (clove honey). Separation of ink by paper chromatography. Separation of amino acids by paper chromatography. Extraction and identification of cardiac glycosides from nerium indicum. Extraction and identification of anthraquinone glycosides from aloe and rhubarb. Soxhlet’s extraction, water and ethanol extraction. Qualitative tests for various alkaloids and glycosides.

RECOMMENDED BOOKS


Chem-305 PHARMACEUTICAL CHEMISTRY-III A (Pharmaceutical Analysis) 4(3-1)

THEORY

NOTE: The topics will be taught with special reference to their Pharmaceutical Applications. The quantitative and qualitative analysis of drugs and drug products utilizing the instrumental techniques and titrimetric techniques.

1. SPECTROSCOPIC METHODS: Theory, Instrumentation and Pharmaceutical Applications of the following Spectroscopic Methods:
   a. Atomic Absorption and Emission Spectroscopy
   b. Molecular Fluorescence Spectroscopy
   c. Flame Photometry
   d. I.R. Spectroscopy
   e. Mass Spectroscopy
   f. NMR Spectroscopy
   g. U.V./Visible Spectroscopy

2. CHROMATOGRAPHIC METHODS: Column Chromatography, Thin Layer Chromatography, Gas Liquid Chromatography, HPLC, LCMS, GCMS, Capillary Electrophoresis.

PRACTICAL

RECOMMENDED BOOKS


PRACTICAL


RECOMMENDED BOOKS

SIXTH SEMESTER

CS-502  PHARMACY PRACTICE-III (Computer and Its Application in Pharmacy)  4(3-1)

THEORY

1. FUNDAMENTALS OF COMPUTERS:
   a. History of Data Processing
   b. Types of Computers
   c. Components of a Computer
   d. Computer System and Business Computer System
   e. Backing Storage Devices
   f. Unit of Memory
   g. Viruses and Anti-viruses Issues

2. RESEARCH METHODOLOGIES:

3. SYSTEM ANALYSIS AND DESIGN:
   a. What is a System?
   b. Steps in system life cycle
   c. Data Gathering and Data Analysis
   d. Designing a New System
   e. Development and Implementation of New System
   f. Documentation.

4. DATA PROCESSING:
   a. Data Processing
   b. The Data Processing Cycle
   c. The Collection and Computing of data
   d. Manual collection of data
   e. The main methods of data input
   f. Devices used to collect data
   g. Data Verification
   h. Data Validation
   i. Output and Recording of data
   j. Types of data processing systems
   k. Types of Computer Operation
   l. Batch Processing and Real-time Processing

5. APPLICATION OF COMPUTERS IN HOSPITAL PHARMACY:
   a. Patterns of Computer use in Hospital Pharmacy
   b. Patient record database management
   c. Medication order entry
   d. Drug labels and list
   e. Intravenous solution and admixture
   f. Patient Medication profiles
   g. Inventory control
   h. Management report & Statistics
6. APPLICATION OF COMPUTER IN COMMUNITY PHARMACY:
   a. Computerizing the Prescription Dispensing process,
   b. Use of Computers for Pharmaceutical Care in community pharmacy,
   c. Accounting and General ledger system.

7. APPLICATION OF DRUG INFORMATION RETRIEVAL & STORAGE:
   a. Introduction
   b. Advantages of Computerized Literature
   c. Retrieval use of Computerized Retrieval

DATA ANALYSIS: Introduction and implementations of statistical design and test. Students T-test, Chi Square, ANOVA using statistical packages like SPSS, Med Calc, Kinetica etc.

PRACTICAL

Operating System: Basic concepts of windows, explanation of start menu, taskbar, desktop, control panel, add/remove software/hardware, windows explorer, my computer, recycle bin.

Microsoft Word: Introduction to MS word, file operations (create, open, save, close etc), editing (cut, copy, paste etc). Different types of views. Inserting operations. Document formatting. Utilities. Table operations. Windows operations.

Microsoft power point: Introduction to MS power point, file operations (create, open, save, close etc), Editing (cut, copy, paste etc). Different types of views. Inserting operations. Document formatting. Utilities. Table operations. Slide shows. Windows operations.

Microsoft Excel: Introduction to MS excel, file operations (create, open, save, close etc), editing (cut, copy, paste etc). Different types of views. Inserting operations. Different types of graphs. Worksheet formatting. Utilities. Data sorting and validations. Windows operation.

Microsoft Front Page: Introduction to front page, creating a first web site, basic formatting techniques, manipulating tables within front page, front page picture and multimedia, hyper linking, bookmarks and image maps, introducing front-page "components", front page and frames, managing your web, good site design, publishing and publicizing.

Internet: network, how internet work, ISP, WSP, internet address, DNS, www< web browser, URL, web server, search engine, type of web pages, web casting, e-commerce, web publishing, e-mail, newsgroup & message board, mailing list and chat room.

Statistical package for special sciences (SPSS): introduction to SPSS and its uses, file operations, transforming data values, aggregating data, data editing features, different viewing patterns, data processing, data analysis, regression and correlation, graphical analysis, utilities for analysis, managing windows.

RECOMMENDED BOOKS

THEORY

1. CHEMOTHERAPY:
   a) Basic principles of chemotherapy.
   b) Antibacterials: (Folate antagonists; sulphonamides. Cell wall synthesis inhibitors; Penicillin, Cephalosporins, Carbapenam, Monobactam. Protein synthesis inhibitors; Aminoglycosides, Tetracyclines, Chloramphenicol, Macrolides. Nucleic acid synthesis inhibitors; Quinolones and miscellaneous Antibiotics), Antimycobacterial drugs, Urinary tract antiseptics.
   c) Anti-fungals:
   d) Anti-virals:
   e) Anti-protozoals: (anti-malarias, anti-amebiasis, anthelmintics and anti-leishmanials).
   f) Anti-neoplastic drugs:

2. IMMUNOPHARMACOLOGY: Pharmacology of immuno-suppressants and stimulants.

3. TOXICOLOGY:
   (a) Pollution and its types (water, air, food)
   (b) Poison and principle of treatment of poisoning.
   (c) Poisoning (Sign & symptom and treatment): Ethanol, Barbiturates, Digitalis, Salicylates, Strychnine, Narcotics, Nicotine, Paracetamol, Benzodiazepines and organophosphorous compounds.
   (d) Chelating agents and their role in poisoning: Dimercaprol, Calcium disodium edentate (Calcium EDTA), Pencillamine and Defroxamine.

NOTE:
- Only an introduction will be given of the banned and obsolete drug products.
- While dealing with Pharmacology stress should be laid to the group actions of related drugs and only important differences should be discussed of the individual drugs placed in same group.
- Newly introduced drugs should be included in the syllabus while drugs with no clinical and therapeutic values ought to be excluded from syllabus at any time.
- The prototype drugs in each group from the latest edition of the recommended books.

PRACTICAL

Antibiotic sensitivity tests (disk method, valve method), microbiological assay, calculations of minimum inhibitory concentrations of various antibiotics, competitive antagonism of drugs such as acetylcholine and atropine in rabbits. Demonstration of strychnine poisoning in laboratory animals.

RECOMMENDED BOOKS

THEORY

1. **VOLATILE OILS (ESSENTIAL OILS):** Introduction, significance, sources, active constituents, methods of obtaining volatile oils, chemistry and classification of:
   (a) **Hydrocarbon volatile oils:** Cubeber and Turpentine oil.
   (b) **Alcoholic volatile oils:** Peppermint, Coriander and Cardamom.
   (c) **Aldehydic volatile oils:** Bitter orange peel, sweet orange peel, Lemon, cinnamon and bitter almond oil.
   (d) **Ketonic volatile oils:** Camphor, spearmint, caraway, Buchu.
   (e) **Phenolic volatile oils:** Clove, Thyme.
   (f) **Phenolic ether volatile oils:** Fennel, Anise, Myristica.
   (g) **Oxide volatile oils:** Eucalyptus, chenopodium.
   (h) **Ester volatile oils:** Rosemary.
   (i) **Miscellaneous volatile oils:** Allium, Anethum.

2. **RESINS AND OLEORESINS:** Introduction, classification, active constituents and pharmacological uses of jalap, turpentine, asafoetida, benzoin, rosin, cannabis, podophyllum, ipomea, myrrh, and balsam.

3. **TANNINS:** Introduction, classification, biosynthesis, extraction, identification, occurrence in plants, their role in plant life and chemical study of tannins in kino, myrobalan, catechu, nutgall, castanea, and krameria.

4. **NATURAL TOXICANTS:**
   a) **General Introduction to Plant Toxicology:** Definition, classification and chemical nature of plant toxins. Plant toxicities in humans and animals.
   b) **Higher Plant Toxins:** Essential oils: Terpene (cineol, pine oil), Phenyl propane (apiole, safranylose, myristiccin), Monoterpane (thujone, menthafruran) Plant acids (oxalic acid, amino acid, resin acid), Glycosides (cardiotonic, cyanogenic), Alkaloids (imidazole, pyrrolizidine, tropane).
   c) **Lower Plant Toxins:** Bacterial toxins (Staphylococcus aureus, Clostridium botulinum), Algal toxins (Microcystis aeruginosa, Cyanobacteria, Gonyaulax cantenella).
   d) **Mycotoxins:** Fungal toxins (Aspergillus spp., Claviceps purpurea), Mushrooms (Amanita spp.).
   e) **Study of Toxins, their Prevention and Control Methods:** Description, pharmacognostic features, pharmacological actions, chemical constituents, treatment, side-effects, contra-indications, warnings, prevention and control methods of Abrus precatorius, Papaver somniferum, Eucalyptus spp., Nicotiana tabacum, Cannabis sativa, Digitalis purpurea, Datura stramonium poisoning.

5. **AN INTRODUCTION TO NUTRACEUTICALS AND COSMECEUTICALS:**

6. **TUMOR INHIBITORS FROM PLANTS:** Introduction of anticancer agents of natural origin, as Catharanthusroseus, Colchicum autumnale, Podophyllum peltatum, rifamycin antibiotics, macrolide antibiotics, anti-AIDS agents and immunostimulants.
7. **INTRODUCTION TO CLINICAL PHARMACOGNOSY:** General introduction and historical background of clinical Pharmacognosy. Study of treatment by herbal medicines

8. **CLINICAL USE OF HERBS & HERBAL MEDICINE:**
   - **Diabetes:** Gymnema sylvestre, Melia azadirchta, Momordica charantia, Syzygium jambulana.
   - **Cardiac diseases:** Digitalis spp., Convallaria majalis, Urgenia indica, Allium sativum, Punica granatum.
   - **Hepatitis:** Berberis vulgaris, Picrorhiza kurroa, Lawsonia innermis.
   - **Respiratory diseases:** Ficus religosa, Adhatoda vasica.
   - **Skin diseases:** Aloe vera, Angelica archangelica, Mentha piperita, Citrus spp., Commiphora mukul.
   - **CNS disorders:** Strychnos nux-vomica, Datura stramonium, Cannabis sativa, Papaver somniferum, Atropa belladonna.
   - **Musculo-skeletal disorders:** Nigella sativa, Phytocis ajowan, Trigonella foenum-graecum, Zingiber officinalis.
   - **Renal disorders:** Cucumis melo, Berberis vulgaris, Zea mays, Tribulus terrestris.
   - **Reproductive disorders:** Saraca indica, Ruta graveolens, Nigella sativa, Glycyrrhiza glabra, Claviceps purpurea, Myristica fragrans.
   - **G.I.T. disorders:** Foeniculum vulgare, Ferula foetida, Cuminum cyminum, Aegle marmelos, Prunus domestica.

**PRACTICAL**

Isolation and separation of active constituents of crude drugs (nux vomica seeds, clove honey, by thin layer chromatography and paper chromatography. Extraction and identification of cardiac glycosides from nerium indicum. Extraction and identification of anthraquinone glycosides from aloe and rhubarb by paper and thin layer chromatography.

**RECOMMENDED BOOKS**


Chem-306  PHARMACEUTICAL CHEMISTRY-IIB  4(3-1)
(Pharmaceutical Analysis)

**THEORY**

1. **ELECTRO CHEMICAL METHODS:** Potentiometry, Polarography and Radiochemical Techniques.
2. **THERMAL ANALYSIS:** Differential Scanning Calorimetry, Differential Thermal Analysis, Thermo Gravimetric Analysis.
3. **TITRIMETRIC ANALYSIS:** Titrmetric analysis of drugs based on neutralization, hydrolysis, oxidation, reduction and non-aqueous titration.

**OCCURRENCE, PROPERTIES, PREPARATION AND APPLICATION OF OFFICIAL INORGANIC COMPOUNDS:** Aluminium Hydroxide, Ammonium Chloride, Sodium Carbonate, Magnesium Carbonate, Lithium Carbonate, Sodium Nitrite, Calcium Gluconate, Antimony Gluconate, Ferrous Fumarate, Ferrous Sulfate and Silver Nitrate.

**PRACTICALS**

Determination of the purity and composition of the unknown drugs by using at least each of the above techniques. Validation of analytical procedures: Text and methodology; Specificity, linearity and range, accuracy, precision, limit of detection, limit of quantification, stability, ruggedness, robustness and system suitability. Quantitative determination of various drugs in pharmaceutical preparations by chromatographic methods and radioimmuno assays.

**RECOMMENDED BOOKS**

7. **HEALTH SYSTEM RESEARCH:** Knowledge skills of research methods, epidemiologic study design, experimental study design, Pre- and post-marketing surveys. Application of various statistical procedures in Pharmacy and Medical Research, causality assessment as well as the sensitivity and specificity tests in pharmacy practice.

8. **PHARMACOECONOMICS:** Pharmacoeconomic modeling & interpretation.

9. **ALTERNATIVE THERAPIES:** Background, philosophy and use of complementary and alternative therapies including herbal medicines, homoeopathy, acupuncture, acupressure, Bach Flower remedies, aromatherapy and reflexology.


**RECOMMENDED BOOKS**


**FOURTH PROFESSIONAL**

**SEVENTH SEMESTER**

**Pharm-D-401 PHARMACY PRACTICE-IVA (Hospital Pharmacy) 3(3-0)**

**THEORY**

1. **INTRODUCTION:**
   a. Role of Pharmacist in Hospital
   b. Minimum standards for pharmacies in Institutions/Hospitals
   c. Research in Hospital Pharmacy

2. **HOSPITAL AND ITS ORGANIZATION:**
   a. Classification of Hospitals
   b. Organizational Pattern
   c. Administration
   d. Clinical Departments
   e. Nursing, Dietetic, Pathology, Blood Bank, Radiology and other supportive services
   f. Role of Pharmacy in Hospital
   g. Hospital Finances
3. **PHARMACY, ITS ORGANIZATION AND PERSONNEL:**
   a. Pharmacy specialist
   b. Drug information Centre
   c. Poison Control Centre and Antidote Bank
   d. Pharmacy Education
   e. Determining the Need of Professional and other departmental staff
   f. Professional services rendered

4. **PHARMACY AND THERAPEUTIC COMMITTEE:**

5. **THE HOSPITAL FORMULARY:**
   a. General Principles and guidelines to develop Formulary
   b. Format
   c. Preparation of the Formulary
   d. Role of Pharmacist
   e. Benefits and problems
   f. Keeping up to date Formulary

6. **DISPENSING TO INPATIENTS:**
   a. Methods of Dispensing & SOP’s
   b. Unit dose dispensing
   c. Other concepts of dispensing, Satellite Pharmacy etc.

7. **DISPENSING TO AMBULATORY PATIENTS:**

8. **DISTRIBUTION OF CONTROL SUBSTANCES:**

9. **DISPENSING DURING OFF-HOURS:**

10. **SAFE USE OF MEDICATION IN THE HOSPITAL:** Medication error; Evaluation & Precautions of Medication Error; Role of Pharmacist in Controlling Medication Error.

**RECOMMENDED BOOKS**


**THEORY**

1. **GENERAL INTRODUCTION TO CLINICAL PHARMACY:**
   - Introduction to clinical pharmacy and related terms, definition, basic components, comparison with other clinical fields, scope of services.
   - General guidelines for clinical pharmacy practice.
   - Patient Counseling Compliance
   - Laboratory Data interpretation
   - Electrolytes management
   - Clinical literature evaluation
   - Drug interactions
• Medication errors

2. **PATIENT PROFILE & PATIENT COUNSELING:**
   a. Patient disease profile
   b. Taking case history
   c. Drug Profile of at least 25 Important Medications e.g. Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cephalosporins, Chlorpheniramine, Cimetidine, Digoxin, Dobutamine, Dopamine, Fluoroquinolone, Frusemide, Lactulose, Macrolides, Metoclopramide, Morphine/Pethedine, Nifedipine, NSAIDS, ORS, Penicillins, Prednisolone, Salbutamol, Vancomycin.
   d. Patient Counseling

3. **CLINICAL TRIALS OF DRUG SUBSTANCES:** Designing of clinical trials, Types of trials, Choice of patients, Exclusion of patients and Monitoring a clinical trial.

4. **EMERGENCY TREATMENT:** For example, Cardiopulmonary resuscitation (CPR), Cold Blue.

5. **DRUG INTERACTIONS:** Mechanism, Physiological factors affecting interaction, Types and level of drug interactions, Role of pharmacist in evaluating drug interaction & its management.

6. **PHARMACOVIGILANCE:**
   a) Scope, definition and aims of Pharmacovigilance

PRACTICAL

Clerkship in the clinical setting. A project related to clinical pharmacy practices will be completed by the students and will be evaluated by the external examiner.

RECOMMENDED BOOKS

THEORY

1. **MASS TRANSFER:**

2. **HEAT TRANSFER:**

3. **DRYING:** Theories of drying, Drying of Solids, Classification of dryers, General Methods, Fluidized Bed systems, Pneumatic systems, Spray dryer, Freeze drying.


5. **MIXING:** Fundamentals, Mechanisms, Mixing Equipment used in Liquid/Liquid, Liquid/Solid and Solid/Solid mixing.


7. **EVAPORATION:** General principles of Evaporation, Evaporators and Evaporation under reduced pressure.

8. **COMPRESSION AND COMPACTION:** The solid-air Interface, Angle of Repose, Flow rates, Mass volume relationship, Density, Heckel Plots, Consolidation, Granulation, Friability, Compression (dry method, wet method, slugging), Physics of Tabletting, tabletting machines and other equipment required, problems involved in tabletting, tablet coating. **Capsulation:** Hard and soft gelatin capsules.

PRACTICAL

Manufacture of tablets by wet granulation method, by slugging and by direct compression. Coating of tablets (sugar coating, film coating and enteric coating), excipients e.g., Flavoring agents, sweeteners, binders etc and shapes of tablets. Classification of liquids by various processes. Size reduction. Homogenization.

RECOMMENDED BOOKS

THEORY

1. DEFINITIONS AND TERMINOLOGY: Biopharmaceutics, Generic Equivalence, Therapeutic Equivalents, Bioavailability, Bioequivalence, Drug Disposition, Pharmacokinetics (LADMER; Liberation, absorption, distribution, metabolism, elimination and response).


5. PHARMACOKINETICS: Introduction, Linear and Non-linear Pharmacokinetics Application of pharmacokinetics in clinical situations.

6. MULTIPLE DOSAGE REGIMEN:
   a. Introduction, principles of superposition
   b. Factors: persistent, accumulation and loss factors
   c. Repetitive Intravenous injections – One Compartment Open Model
   d. Repetitive Extravascular dosing – One Compartment Open model
   e. Multiple Dose Regimen – Two Compartment Open Model

7. CONCEPT OF COMPARTMENT(S) MODELS:
   I. One compartment open model.
      a. Intravenous Injection (Bolus)
      b. Intravenous infusion.
   II. Multicompartment models.
      a. Two compartment open model.
      b. IV bolus, IV infusion and oral administration
   III. Non-compartmental Model.
      a. Statistical Moment Theory
      b. MRT for various compartment models
      c. Physiological Pharmacokinetic model

PRACTICAL
Blood Sampling techniques: In laboratory animals like dog, rabbits, mice etc. In human beings, in-vitro dissolution studies, optional dose determination, measurement of rate of bioavailability of commonly used drugs, powders, parenterals, syrups etc. Determination of relative and absolute bioavailability of most commonly used drugs as Paracetamol, aspirin, tetracyclines. Plasma level-time curve (Determination of Pharmacokinetic parameters). Determination of plasma protein binding. Urinary sampling techniques in laboratory animals. Renal excretion of drugs or drug disposition in animals and humans

RECOMMENDED BOOKS
THEORY

1. **INTRODUCTION:**
   (a) Basic concepts and introduction of pharmaceutical industry in relevance to quality assurance and quality control departments, testing, quality management system, quality assurance, quality control and quality standards.
   (b) General understanding of good laboratory practices and validation

2. **QUALITY CONTROL OF SOLID DOSAGE FORMS:**
   (a) Physical tests: Hardness, Thickness and Diameter, Friability, Disintegration, Weight Variation.
   (b) Chemical tests: Content uniformity, Assay of active ingredient and dissolution tests of Powders, Granules, Tablets and Capsules.

3. **QUALITY CONTROL OF SYRUPS, ELIXIRS and DISPERSE SYSTEM:** Viscosity, its determination and application in the Quality Control of Pharmaceuticals, Weight per ml and Assay of active ingredient.

4. **QUALITY CONTROL OF SUPPOSITORYES:** Dissolution test, Uniformity of weight, Assay of active ingredient, Liquefaction time test and Breaking test.

5. **QUALITY CONTROL OF STERILE PRODUCTS (PARENTERALS):** Sterility Test and Sterile section management, Leaker’s test, Clarity test, Pyrogen test for Parenteral and other sterile preparations, Assay for active ingredient.


PRACTICAL
Assay of various spirits, tinctures, extracts, syrups and elixirs, assay of ointments and suppositories, assay of tablets and capsules, test for alkalinity of glass, determination of alcohol contents in the pharmaceutical preparations and Pyrogen tests in rabbits and guinea Pigs. Determination of Ash contents, Determination of Moisture contents, Determination of total solids, Determination of viscosity of syrups, gels, etc., Determination of emulsion types.

RECOMMENDED BOOKS

EIGHTH SEMSTER

Pharm-D-406 PHARMACY PRACTICE-IVA (Hospital Pharmacy) 3(3-0)

THEORY

1. MANUFACTURING BULK AND STERILE:

2. THE PHARMACY: CENTRAL STERILE SUPPLY ROOM:

3. ASEPTIC DISPENSING: TPN, I/V Admixtures, Cytotoxic Dispensing, Semi-sterile Dispensing (Eye drops, Ear drops) and Hyperalimentation.

4. ROLE OF PHARMACIST IN SMALL HOSPITALS, NURSING HOMES etc.


6. NUCLEAR PHARMACY:

7. THE PHYSICAL PLANT AND ITS EQUIPMENT:

8. INVESTIGATIONAL USE OF DRUGS:

9. HEALTH ACCESSORIES:

10. SURGICAL SUPPLIES:

11. INSPECTION OF WARDS WITH REFERENCE TO DRUG STORAGE AND ADMINISTRATION:

12. MANAGEMENT OF ACCIDENT & EMERGENCY PHARMACY (A & E):

RECOMMENDED BOOKS


Pharm-D-407 PHARMACY PRACTICE-VB (Clinical Pharmacy) 4(3-1)

THEORY

1. PHARMACOTHERAPY PLAN:
   a. Developing, Implementing and Monitoring Drug Therapy Plans:
      • Pharmacist work up of drug therapy (PWDT)
      • Documentation of Pharmacotherapy Plan
         o SOAP note
         o CORE Pharmacotherapy Plan
         o PRIME Pharmacotherapy problems
FARM note

- Implementation of Drug Therapy Plan
- Monitoring of Pharmacotherapeutic plan
- Pharmaceutical care plan as ongoing process
- Importance of drug therapy plan in today’s pharmacy practice.

b. Pharmacotherapy Decision-Making:
   - Pursue the role of drug therapy practitioner over that of drug therapy advisor.
   - Participate in pharmacotherapy decision-making by:
     a) Identifying opportunities for decision-making.
     b) Proactively engaging decision-making opportunities.
     c) Formulating decision rationale that is the result of rigorous inquiry, scientific reasoning, and evidence.
     d) Pursuing the highest levels of decision-making.
     e) Seeking independence in making decisions and accepting personal responsibility for the outcomes to patients resulting from one’s decisions.
     f) Personally enacting decisions.

2. DRUG INDUCED DISEASES:


1. ON LINE PHARMACEUTICAL CARE SERVICES AND GLOBALIZATION:

2. PROVISION OF PHARMACEUTICAL CARE IN MULTIPLE ENVIRONMENTS: Professionalism, physical assessment, body substance precautions and the relationships between culture, race and gender to pharmaceutical care.

6. DISEASE MANAGEMENT: Disease management should be covered by considering aspects like definition of disease, etiology, pathogenesis, clinical presentation, diagnostic work out (briefly), pharmacotherapy.

- Unit I: Cardiovascular unit (hypertension, ischemic heart diseases e.g. angina pectoris, MI, Heart failure)
- Unit II: Pulmonary unit (Asthma e.g. acute & chronic, status asthmaticus, childhood asthma, Pneumonia, COPD includes emphysema & chronic bronchitis)
- Unit III: Gastroenterology unit (ulcer, liver cirrhosis, portal hypertension, hepatitis, inflammatory bowel disease, diarrhoea)

PRACTICAL

- Clerkship in the Clinical Setting. A report Related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.
- Students will also complete a report independently or in a group on a Drug Use Evaluation.
- Students will take the assignment tasks to enhance verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects.
RECOMMENDED BOOKS

Pharm-D-408 PHARMACEUTICS-IVB (Industrial Pharmacy) 4(3-1)

THEORY

1. **EMULSIONS:** Mechanical Equipments, Specific formulation consideration and Emulsion stability.
2. **SUSPENSIONS:** Formulation of suspensions, Equipment used in preparation and test methods for pharmaceutical suspensions.
3. **SEMISOLIDS:** Equipment used for Ointments, Pastes, Gels and Jellies. Packaging of ointments.
4. **EQUIPMENTS USED FOR:** Patches, Sprays, Implants, Sutures, Plasters and Sachet packing.
5. **STERILE PRODUCTS:** Sterile area and its Classification, Ophthalmic ointments, Preparation of parenterals (Building, Equipment), Complete Sterility (Aseptic area), air control, (Laminar flow etc.), air locks, Environmental monitoring methods, Sterilization, Filling/Packaging (Plastic and glass containers), Added substances (Preservatives, anti-oxidants, solubilizer, suspending agents, buffers, stabilizers etc.), Inprocess Quality Control of Parenterals (Sterility, leakage, pyrogens, clarity etc.).
7. **SAFETY METHODS IN PHARMACEUTICAL INDUSTRY:**
   (a) Mechanical, chemical and fire hazards problems.
   (b) Inflammable gases and dusts.

**NOTE:** **STUDY TOUR:** A visit to the pharmaceutical industries will be an integral part of the syllabus and will prepare and submit a report about operations in Pharmaceutical industry that will be evaluated in practical examination.

**PRACTICAL**

**RECOMMENDED BOOKS**


**Pharm-D-409 PHARMACEUTICS-VB (Biopharmaceutics and Pharmacokinetics) 4(3-1)**

**THEORY**

1. **ELIMINATION OF DRUGS:**
   a) **Hepatic Elimination**: Percent of Drug Metabolized, Drug Biotransformation reactions, (Phase-I reactions and phase-II reactions), First pass effect, Hepatic clearance of protein bound drugs and Biliary excretion of drugs.
   b) **Renal Excretion of Drugs**: Renal clearance, Tubular Secretion and Tubular Reabsorption.
   c) **Elimination of Drugs through other organs**: Pulmonary excretion, salivary excretion, Mammilary excretion, Skin excretion and Genital excretion.

2. **PROTEIN BINDING**: Introduction, types, kinetics, determination and clinical significance of drug-protein binding.

3. **PHARMACOKINETICS VARIATIONS IN DISEASE STATES**: Determination of pharmacokinetics variations in renal and hepatic diseases, general approaches for dose adjustment in renal disease and hepatic diseases.

4. **PHARMACOKINETICS OF INTRAVENOUS INFUSIONS**:

5. **BIOPHARMACEUTICAL ASPECTS IN DEVELOPING A DOSAGE FORM**: Drug considerations, drug product considerations, patient considerations, manufacturing considerations, pharmacodynamic considerations pharmacokinetic considerations.

6. **BIOAVAILABILITY AND BIOEQUIVALENCE**:
   a. Introduction.
   b. Bioavailability types, parameters, significance and study protocol.
   c. Methods of Assessment of Bioavailability.
   d. Bioequivalence study designs, components and application, report format.

**IN-VITRO-IN-VIVO CORRELATION (IVIVC)**: Introduction, levels and determination of in-vitro/in-vivo correlation.

**PRACTICAL**

RECOMMENDED BOOKS


Pharm-D-410 PHARMACEUTICS-VIB 4(3-1)
(Pharmaceutical Quality Management)

THEORY

1. BIOLOGICAL ASSAYS: Biological methods, Standard preparations and units of activity, Bioassay of antibiotics, Bioassay of insulin injection, Assay of prepared digitalis and Assay of Vitamin D.

2. ALCOHOL DETERMINATION: Alcholometric methods, Problem during distillation of alcohol, Method for liquids containing less than 30% or more than 30% alcohol and special treatment before distillation.

3. ALKALOIDAL DRUG ASSAY: Weighing for assay, Extraction of drugs, Maceration, Percolation, Continuous extraction, Purification of Alkaloids and determination of alkaloids.

4. QUALITY ASSURANCE OF VACCINES: Introduction, Quality measures for stability of vaccines, potency testing, and post market surveillance of vaccines.


6. STATISTICAL INTERPRETATION OF QUALITY CONTROL CHARTS DURING MANUFACTURING PROCESSES:

PRACTICAL

Sterility test of various pharmaceutical preparations e.g., parenterals, determination of ash contents, determination of moisture contents of tablets, powders, granules etc, determination of total solids, determination of viscosity of syrups, gels, etc. Determination of enulsion types of lotion, liniments, milk etc.

RECOMMENDED BOOKS


FIFTH PROFESSIONAL

NINTH SEMESTER

Chem-504 PHARMACEUTICAL CHEMISTRY-IVA

(Medicinal Chemistry)

4(3-1)

THEORY

NOTE: The topics will be taught with special reference to their Pharmaceutical Applications.

1. **INTRODUCTION TO MEDICINAL CHEMISTRY:** Chemical constitution and biological activity: (Receptor, Theory, Structure Activity Relationships (SAR) and Drug Metabolism). Modern concept of rational drug design, prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules.

2. **DRUG TARGETS AND DRUG DESIGNING:**
   a. Introduction and types of drug targets
   b. Introduction to molecular modeling and computational chemistry
   c. Structure based designing
   d. Ligand based designing
   e. Various techniques in drug synthesis

3. **GENERAL PROPERTIES, CHEMISTRY, BIOLOGICAL ACTION, STRUCTURE ACTIVITY RELATIONSHIP AND THE THERAPEUTIC APPLICATIONS OF THE FOLLOWING:**
   a. **Hormones:** Steroidal Hormones (Testosterone, Progesterone, Estrogen, Aldosteron and Cortisol), Proteinous Hormones (Insulin, Glucagon, Oxytocin and Vassopressin).
   b. **Anti-neoplastic Agents:** Tamoxifen, Fluouracil, Mercapturine, Methotrexate and Vincristine.
   c. **Sedatives & Hypnotics:** Benzodiazepines, Barbiturates, Paraaldehyde, Glutethimide, Chloral hydrate, and alcohols.
   d. **Anaesthetics:** Local anaesthetics (Procaine, Lignocaine, Eucaine, Cocaine and Benzocaine), General anaesthetics (Cyclopropane, Halothane, Nitrous oxide, Chloroform, Thiopental Sodium, Ketamine, Methohexital, Thioamylal Sodium, Fantanyl Citrate, Tribromo ethanol).
   e. **Analgesics and Antipyretics:** Paracetamol, Salicylic acid analogues, Quinolines derivatives, Pyrazolone and Pyrazolodiones, N- arylanthranilic acids, Aryl and heteroaryl acetic acid derivatives.

PRACTICAL

Estimation of functional groups; Carboxylic, Hydroxy, Amino and Nitro groups; Determination of Molecular weights of Organic Compounds. Synthesis of paracetamol, salicylic acid, methyl salicylate, azobenzene, benzoic acid, 5-hydroxy-I, 3-benzoaxazol-2-one, aspirin, p-nitrosophenol, 3-nigtrophhalic acid, o-chloro-benzoic acid. Inorganic preparations and assay.
RECOMMENDED BOOKS


Pharm-D-501 PHARMACY PRACTICE-VIA (Advanced Clinical Pharmacy) 4(3-1)

THEORY

1. **RATIONAL USE OF DRUGS:** Rational Prescribing, Rational Dispensing, Problems of Irrational Drug Use, Learning about drug use problem, Sampling to study drug use, Indicators of drug use.

2. **INTRODUCTION TO ESSENTIAL DRUGS:** Criteria for selection, Usage and Advantages. Development of EDL.

3. **DISEASE MANAGEMENT:**
   - Unit V: Central nervous system unit (Stroke, epilepsy, Psychosis)
   - Unit VI: Infectious diseases (Meningitis, tuberculosis, dermatological infections, Rabies, Urinary tract infection, Malaria fever, typhoid fever, fungal infections of skin, Dengue Fever, Common Cold, Pharyngitis & Tonsillitis, Conjunctivitis)
   - Unit VII: Endocrinology Unit (Diabetes Mellitus, Hyper/Hypo thyroidism, pitutary gland non-malignant disorders)

4. **DRUG UTILIZATION EVALUATION & DRUG UTILIZATION REVIEW (DUE/DUR):** Development of protocol of use of few very low therapeutic index drug groups like Steroids, Vancomycin and Cimetidine.

5. **CLINICAL PHARMACOKINETICS:** Therapeutic Drug Monitoring of Digoxin, Theophyline, Gentamycin, Lithium, Phenytin, Cabamazepine, Phenobarbitone, Valproic Acid, Cyclosporins and Vancomycin.

PRACTICAL

- Clerkship in the Clinical Setting. A project Related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.
- Students are required to participate in verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects.

RECOMMENDED BOOKS


Pharm-D-502 PHARMACEUTICS-VIIA 4(3-1)
(Pharmaceutical Technology)

THEORY

1. **PRINCIPLES OF PHARMACEUTICAL FORMULATION AND DOSAGE FORM DESIGN**: Need for dosage form; Preformulation Studies; Product Formulation.

2. **ADVANCED GRANULATION TECHNOLOGY (DESIGN & PRACTICE)**: Spray Drying Granulation Technology; Roller Compaction Technology; Extrusion/Spheronization as a Granulation Technique; Single Pot Processing.

   **Granulation Technology**: Rapid Release Granulation Technique; Particle Coating by Centrifugation Granulation Technology.

3. **POLYMERS USED IN DRUG DELIVERY SYSTEMS**:

4. **NOVEL DRUG DELIVERY SYSTEM (DDS)**:

   Sustained/ Controlled Release Drug Delivery System
   
i) Microencapsulation technique
   • Coacervation
   • Solvent evaporation
   • Interfacial polymerization
   • Spray drying
   ii) Developmental aspects of Matrix and Reservoir Systems

PRACTICAL

Various techniques to develop the formulation, granulation technology, study of drug delivery systems, bio-technological aspect of product development, In-vitro quality control of various dosage forms (tablets, capsules, syrups, elixirs, powders, lotion, suppositories etc).

RECOMMENDED BOOKS


Pharm-D-503  PHARMACY PRACTICE-VIIA (Forensic Pharmacy) 3(3-0)

THEORY

1. GENERAL INTRODUCTION: Forensic Pharmacy & Forensic Pharmacist, History of Drug Legislation and Pharmacy Profession in Pakistan, National Health Policy, National Drug Policy, Essential Drugs, Prescription handling at Retail level and Recordkeeping, Drug Control Administration at Federal and Provincial level.

2. ROLE OF FORENSIC PHARMACIST: Forensic drug measurement, Post-mortem redistribution (PMR), Medication errors, prescription forgery, product tampering, Insurance fraud, Use of drugs or alcohol in car accidents or violent actions, Legal and illegal pharmaceutical evidence in criminal investigations, use of abused drugs in the workplace, professional malpractice, quackery and health care fraud.


4. STUDY OF DRUG LAWS:
   a. The Drugs Act 1976 and rules framed there under.
   b. Provincial Drug Rules (Respective Drug Rules will be taught in the relevant province).
   c. Advertisement rules.
   d. Other Related rules and Legal aspects.

RECOMMENDED BOOKS


AE-504  PHARMACY PRACTICE-VIIA (Pharmaceutical Management & Marketing) 3(3-0)

THEORY

1. MANAGEMENT & MARKETING:
   b. Types and Functions of Managers
   c. Planning: Purpose and types of Planning, Steps in Planning
   d. Organizing
   f. Motivation
   g. Innovation and creativity
h. Principals of Marketing
i. Product Management
j. Marketing Research

2. **PRODUCTION MANAGEMENT:** Material Management, Planning of production, Batch record maintenance.

**TEXT BOOKS**


**RECOMMENDED BOOKS**


**TENTH SESMETER**

**Chem-505**  
**PHARMACUETICAL CHEMISTRY-IVB**  
(4(3-1))  
**THEORY**

NOTE: The topics will be taught with special reference to their Pharmaceutical Applications.

**GENERAL PROPERTIES, CHEMISTRY BIOLOGICAL ACTION, STRUCTURE ACTIVITY RELATIONSHIP AND THERAPEUTIC APPLICATIONS OF THE FOLLOWING:**

a. **Sulphonamides:** Prontosil, sulphanalamide, Sulphapyridine, sulphadimidine, Sulframethoxazole, Sulfadiazine and Sulfafurazole.

b. **Antimalarial:** 4-Aminoquinolines, 8-Aminoquinolines, 9-Amino acridines, Biguanides, Pyrimidine analogues, Mefloquine and Cinchona alkaloids.

c. **Diuretics:** Mercaptomerin, Meralluride, Thiazides, Spirironolactone, Theophylline, Furosemide, Acetzolamide, Ethacrynic acid and Triameterene.

d. **Antitubercular Drugs:** Ethambutol, Isonicotinic acid, Hydrazid, Rifampacin, Thiouguanine, Pyrazinamide, cycloserine, Ethunamide, Cytarabine, 5-Flourouracil and Darcarbazine.

e. **Antiviral Drugs:** Acyclovir, Tromantadine Hydrochloride and Ribavirin.

f. **Immunosuppressant Agents:** Azathioprine and Cyclosporin.

g. **Antibiotics:** Penicillins, Cephalosporins, Streptomycin, Chloramphenicol, Tetracyclines, Kanamycin and Erythromycin.
PRACTICAL

Assay of the drugs (10) like, Sulpha drugs, aspirin, paracetamol, benzyl penicillin, isoniazid, kanamycin etc and some of their metabolites in biological samples. Determination of drug level (cannabinoids or other drugs of addiction) in biological fluids (blood/plasma, urine).

RECOMMENDED BOOKS

Pharm-D-505 PHARMACY PRACTICE-VIB (Advanced Clinical Pharmacy) 4(3-1)

THEORY
1. PHARMACEUTICAL CARE, ITS SCOPE, MANAGEMENT AND APPLICATIONS:
2. CLINICAL THERAPEUTICS:
3. DISEASE MANAGEMENT:
   • Unit VIII : Oncology Unit ( Types of tumors, Introduction to Oncological diseases e.g., Prostate cancer, Breast cancer, Lungs cancer)
   • Unit IX: Nephrology Unit (Renal failure, nephrotic syndrome)
   • Unit X: Hematology Unit (Bleeding disorders/coagulopathies/ clotting disorders e.g. thrombocytopenia, hemophilia, Vit. K deficiency, Anemia)
4. CLINICAL TOXICOLOGY:
   a. General information. Role of pharmacist in treatment of poisoning and general management of poisoning & over dosage. Role and status of Poison Control Centre.
   b. Antidotes and their mechanism of action.
   SAFE INTRAVENOUS THERAPY & HAZARDS OF I.V. THERAPY:
   NON-COMPLIANCE: Definition, introduction and importance, Extent of non-compliance, Methods of assessment, Reasons for non-compliance, Strategies for improving compliance.

PRACTICAL
• Clerkship in the Clinical Setting. A project Related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.
• Students are required to take/present verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects.
RECOMMENDED BOOKS


Pharm-D-506 PHARMACUETICS-VIIB (Pharmaceutical Technology) 4(3-1)

THEORY

1. **NOVEL GIT DRUG DELIVERY SYSTEM:**
   a. Oral Osmotic Pumps
   b. Ion-Exchange Controlled DDS
   c. pH-Controlled DDS
   d. Bio/mucoadhesive DDS
   e. Floating DDS

2. **DRUG CARRIER SYSTEM:**
   a. Liposomes
   b. Niosomes

3. **TARGETED DRUG DELIVERY SYSTEM:**
   a. Active Drug Delivery System
   b. Passive Drug Delivery System

4. **PHARMACEUTICAL BIOTECHNOLOGY:**
   a. Introduction to Biotechnology: Genetics/Genomics, Proteomics, Biomolecular target Identification, Pharmacogenomics, Gene therapy and Nucleic acid therapeutics.
   b. Techniques Used in Pharmaceutical biotechnology: PCR, DNA Sequencing, Affinity Protein Purification.
   d. Pharmaceutical Recombinant therapeutic Proteins, Growth factors, Therapeutic antibodies, High-throughput screening of putative therapeutic compounds.
   e. Biotechnological aspects in the product development.
   g. Immobilized Enzymes and their application in Medicine.
PRACTICAL

Microbial assay of various pharmaceutical preparations as syrups, elixirs, ointments, lotions, liniments etc, Particle size analysis using various methods e.g., sieving, Stability studies of pharmaceuticals as powders, tablets, granules etc, coating of particles and to prepare, examine and control specifications of packaging materials and packaging methods.

RECOMMENDED BOOKS


THEORY

1. THE PHARMACY ACT 1967:

2. CONTROL OF NARCOTICS SUBSTANCES ACT 1997: Laws relating to Narcotic drugs and psychotropic substances.

3. THE POISONS ACT 1919:

4. THE FACTORIES ACT 1934:

5. SHOPS AND ESTABLISHMENTS ORDINANCE 1969 WITH RULES:

RECOMMENDED BOOKS


MAB-508 PHARMACY PRCTICE-VIIB  (Pharmaceutical Management & Marketing) 3(3-0)

THEORY

1. MARKETING MANAGEMENT:
   a. Ethical consideration of Pharmaceutical Marketing
   b. Difference between Pharmaceutical Marketing and Consumer Marketing
   c. Major stakeholders within pharmaceutical market environment.
d. Marketing Research (Process and Methodology)

e. Market Analysis Techniques 3Cs (Customer analysis, Company analysis, competitors analysis)

f. Evaluating the marketing performance (audit tools and audit process)

g. Designing sales force structure, sales force size and sales quota

h. Marketing channels, Promotion and Advertising and Salesmanship.

2. **SALES MANAGEMENT:** Personnel, Buying, Receiving, Pricing, Sales promotion and Customer Services.

3. **BUSINESS DEVELOPMENT MANAGEMENT:** General principles, strategies, short and long term planning and objectives.

4. **BUSINESS COMMUNICATION:** Importance and benefits of business communication, components of communication, concept and problems of communication, 7C’s of communications.

5. **STRATEGIES FOR SUCCESSFUL BUSINESS AND GLOBAL MEETINGS:** Background information on groups, purpose and kinds of meetings, solving problems in meetings, leadership responsibilities in meetings, participant’s responsibilities in meetings.

**RECOMMENDED BOOKS**


# Scheme of Study for Pharm-D Degree Program

## FIRST SEMESTER

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Credit hours</th>
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<tbody>
<tr>
<td>Chem-103</td>
<td>Pharmaceutical chemistry-IA (Organic)</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>Biochem-105</td>
<td>Pharmaceutical chemistry-IIA (Biochemistry)</td>
<td>4(3-1)</td>
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<tr>
<td>Pharm-D-101</td>
<td>Pharmaceuticals-IA (Physical Pharmacy)</td>
<td>4(3-1)</td>
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<tr>
<td>Pharm-D-102</td>
<td>Physiology-A</td>
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<tr>
<td>Anat-105</td>
<td>Anatomy</td>
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<td>Anat-106</td>
<td>Histology</td>
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<td>Eng-102</td>
<td>English-A (Functional English)</td>
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<td>Pharmaceutical Chemistry-IB (Organic)</td>
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<tr>
<td>Biochem-106</td>
<td>Pharmaceutical Chemistry-IIIB (Biochemistry)</td>
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<td>Pharm-D-103</td>
<td>Pharmaceuticals-IB (Physical Pharmacy)</td>
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<td>Pharm-D-104</td>
<td>Physiology-B</td>
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<tr>
<td>Eng-103</td>
<td>English-B (Communication and writing skills)</td>
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## THIRD SEMESTER

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<td>Pharmaceuticals-IIA (Dosage Form Science)</td>
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<tr>
<td>Pharm-D-202</td>
<td>Pharmacology &amp; Therapeutics-IA</td>
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<td>Pharm-D-203</td>
<td>Pharmacognosy-IA (Basic)</td>
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<td>Micro-413</td>
<td>Pharmaceuticals-III A (Pharmaceutical Microbiology and Immunology)</td>
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<td>IS-201</td>
<td>Islamic Studies</td>
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<td>Math-101</td>
<td>Pharmacy Practice-IA (Pharmaceutical Mathematics)</td>
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## FOURTH SEMESTER

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<td>Pharmaceuticals-IIIB (Dosage Form Science)</td>
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<td>Pharm-D-206</td>
<td>Pharmacology &amp; Therapeutics-IB</td>
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<td>Micro-414</td>
<td>Pharmaceuticals-IIIIB (Pharmaceutical Microbiology and Immunology)</td>
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<td>SSH-201</td>
<td>Pakistan Studies</td>
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<td>Stat-101</td>
<td>Pharmacy Practice-IB (Bio-statistics)</td>
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## FIFTH SEMESTER

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<td>Pathology</td>
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<td>Pharmacology &amp; Therapeutics-IIA</td>
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<tr>
<td>Pharm-D-302</td>
<td>Pharmacognosy-IIA (Advanced)</td>
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<td>Chem-305</td>
<td>Pharmaceutical Chemistry-III A (Pharmaceutical Analysis)</td>
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<td>Pharm-D-303</td>
<td>Pharmacy Practice-IIA (Dispensing Pharmacy)</td>
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### SIXTH SEMESTER

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<td>CS-502</td>
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<td>Pharm-D-304</td>
<td>Pharmacology and Therapeutics-IIB</td>
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<td>Pharm-D-305</td>
<td>Pharmacognosy-IIB (Advanced)</td>
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<td>Chem-306</td>
<td>Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis)</td>
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<tr>
<td>Pharm-D-306</td>
<td>Pharmacy Practice-IIB (Community, Social and Administrative Pharmacy)</td>
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### SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
<th>Credit hours</th>
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<tbody>
<tr>
<td>Pharm-D-401</td>
<td>Pharmacy Practice-IVA (Hospital Pharmacy)</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>Pharm-D-402</td>
<td>Pharmacy Practice-VA (Clinical Pharmacy)</td>
<td>4(3-1)</td>
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<tr>
<td>Pharm-D-403</td>
<td>Pharmaceutics-IVA (Industrial Pharmacy)</td>
<td>4(3-1)</td>
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<tr>
<td>Pharm-D-404</td>
<td>Pharmaceutics-VA (Biopharmaceutics and Pharmacokinetics)</td>
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<td>Pharm-D-405</td>
<td>Pharmaceutics-VIA (Pharmaceutical Quality Management)</td>
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### EIGHTH SEMESTER

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<th>Credit hours</th>
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<tbody>
<tr>
<td>Pharm-D-406</td>
<td>Pharmacy Practice-IVB (Hospital Pharmacy)</td>
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<tr>
<td>Pharm-D-407</td>
<td>Pharmacy Practice-VB (Clinical Pharmacy)</td>
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<td>Pharm-D-408</td>
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<td>Pharm-D-409</td>
<td>Pharmaceutics-VB (Biopharmaceutics and Pharmacokinetics)</td>
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<td>Pharm-D-410</td>
<td>Pharmaceutics-VIB (Pharmaceutical Quality Management)</td>
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### NINTH SEMESTER

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<th>Course No.</th>
<th>Title</th>
<th>Credit hours</th>
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<tbody>
<tr>
<td>Chem-504</td>
<td>Pharmaceutical Chemistry-IVA (Medicinal Chemistry)</td>
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<tr>
<td>Pharm-D-501</td>
<td>Pharmacy Practice-VIA (Advanced Clinical Pharmacy)</td>
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<tr>
<td>Pharm-D-502</td>
<td>Pharmaceutics-VIIA (Pharmaceutical Technology)</td>
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<tr>
<td>Pharm-D-503</td>
<td>Pharmacy Practice-VIIA (Forensic Pharmacy)</td>
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<td>AE-504</td>
<td>Pharmacy Practice-VIIIA (Pharmaceutical Management and Marketing)</td>
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### TENTH SEMESTER

<table>
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<tr>
<td>Chem-505</td>
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<tr>
<td>Pharm-D-505</td>
<td>Pharmacy Practice-VIB (Advanced Clinical Pharmacy)</td>
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<td>Pharmaceutics-VIIB (Pharmaceutical Technology)</td>
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<tr>
<td>Pharm-D-507</td>
<td>Pharmacy Practice-VIIB (Forensic Pharmacy)</td>
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<td>MAB-508</td>
<td>Pharmacy Practice-VIIB (Pharmaceutical Management and Marketing)</td>
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**Grand Total:** 201