Scheme of Course for Pharm. D (Five Years Course)

1st Professional Pharm. D

1st Semester			2nd Semester		
Course No.	**Subject**	**Cr. Hr.**	**Course No.**	**Subject**	**Cr. Hr.**
Pharm-111	English-A (Functional English)	2	Pharm-121	English-B (Communication & Writing Skills)	4
Pharm-112	Pharmaceutics-IA (Physical Pharmacy) [TH]	3	Pharm-122	Pharmaceutics-IB (Physical Pharmacy) [TH]	3
Pharm-113	Pharmaceutics-IA (Physical Pharmacy) [LAB]	1	Pharm-123	Pharmaceutics-IB (Physical Pharmacy) [LAB]	1
Pharm-114	Pharmaceutical Chemistry-IA (Organic) [TH]	3	Pharm-124	Pharmaceutical Chemistry-IB (Organic) [TH]	3
Pharm-115	Pharmaceutical Chemistry-IA (Organic) [LAB]	1	Pharm-125	Pharmaceutical Chemistry-IB (Organic) [LAB]	1
Pharm-116	Pharmaceutical Chemistry-IIA (Biochemistry) [TH]	3	Pharm-126	Pharmaceutical Chemistry-IIB (Biochemistry) [TH]	3
Pharm-117	Pharmaceutical Chemistry-IIA (Biochemistry) [LAB]	1	Pharm-127	Pharmaceutical Chemistry-IIB (Biochemistry) [LAB]	1
Pharm-118	Physiology-A [TH]	3	Pharm-128	Physiology-B [TH]	3
Pharm-119	Physiology-A [LAB]	1	Pharm-129	Physiology-B [LAB]	1
Pharm-1110	Anatomy & Histology [TH]	3			
Pharm-1111	Anatomy & Histology [LAB]	1			
	Total Cr. Hr. 22			**Total Cr. Hr. 20**	

2nd Professional Pharm. D

3rd Semester			4th Semester		
Course No.	**Subject**	**Cr. Hr.**	**Course No.**	**Subject**	**Cr. Hr.**
Pharm-231	Islamic Studies	3	Pharm-241	Pakistan Studies	2
Pharm-232	Pharmaceutics-IIA (Dosage Form Sciences) [TH]	3	Pharm-242	Pharmaceutics-IIB (Dosage Form Sciences) [TH]	3
Pharm-233	Pharmaceutics-IIA (Dosage Form Sciences) [LAB]	1	Pharm-243	Pharmaceutics-IIB (Dosage Form Sciences) [LAB]	1
Pharm-234	Pharmaceutics-IIIA (Pharmaceutical Microbiology & Immunology) [TH]	3	Pharm-244	Pharmaceutics-IIIB (Pharmaceutical Microbiology & Immunology) [TH]	3
Pharm-235	Pharmaceutics-IIIA (Pharmaceutical Microbiology & Immunology) [LAB]	1	Pharm-245	Pharmaceutics-IIIB (Pharmaceutical Microbiology & Immunology) [LAB]	1
Pharm-236	Pharmacology & Therapeutics-IA [TH]	3	Pharm-246	Pharmacology & Therapeutics-IB [TH]	3
Pharm-237	Pharmacology & Therapeutics-IA [LAB]	1	Pharm-247	Pharmacology & Therapeutics-IB [LAB]	1
Pharm-238	Pharmacognosy-IA (Basic) [TH]	3	Pharm-248	Pharmacognosy-IB (Basic) [TH]	3
Pharm-239	Pharmacognosy-IA (Basic) [LAB]	1	Pharm-249	Pharmacognosy-IB (Basic) [LAB]	1
Pharm-2310	Pharmacy Practice-IA (Pharmaceutical Mathematics)	3	Pharm-2410	Pharmacy Practice-IB (Bio-statistics)	3
	Total Cr. Hr. 22			**Total Cr. Hr. 21**	

3rd Professional Pharm. D

5th Semester			6th Semester		
Course No.	**Subject**	**Cr. Hr.**	**Course No.**	**Subject**	**Cr. Hr.**
Pharm-351	Pharmacy Practice-IIA (Dispensing Pharmacy) [TH]	3	Pharm-361	Pharmacy Practice-IIB (Community Pharmacy) [TH]	3
Pharm-352	Pharmacy Practice-IIA (Dispensing Pharmacy) [LAB]	1	Pharm-362	Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis) [TH]	3
Pharm-353	Pharmaceutical Chemistry-IIIA (Pharmaceutical Analysis) [TH]	3	Pharm-363	Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis) [LAB]	1
Pharm-354	Pharmaceutical Chemistry-IIIA (Pharmaceutical Analysis) [LAB]	1	Pharm-364	Pharmacology & Therapeutics-IIB [TH]	3
Pharm-355	Pharmacology & Therapeutics-IIA [TH]	3	Pharm-365	Pharmacology & Therapeutics-IIB [LAB]	1
Pharm-356	Pharmacology & Therapeutics-IIA [LAB]	1	Pharm-366	Pharmacognosy-IIB (Advance) [TH]	3
Pharm-357	Pharmacognosy-IIA (Advance) [TH]	3	Pharm-367	Pharmacognosy-IIB (Advance) [LAB]	1
Pharm-358	Pharmacognosy-IIA (Advance) [LAB]	1	Pharm-368	Pharmacy Practice-III (Computer and Its Applications in Pharmacy) [TH]	3
Pharm-359	Pathology [TH]	3	Pharm-369	Pharmacy Practice-III (Computer and Its Applications in Pharmacy) [TH]	1
Pharm-3510	Pathology [LAB]	1			
	Total Cr. Hr. 20			**Total Cr. Hr. 19**	

4th Professional Pharm. D

7th Semester			8th Semester		
Course No.	**Subject**	**Cr. Hr.**	**Course No.**	**Subject**	**Cr. Hr.**
Pharm-471	Pharmacy Practice-IVA (Hospital Pharmacy) [TH]	3	Pharm-481	Pharmacy Practice-IVB (Hospital Pharmacy) [TH]	3
Pharm-472	Pharmacy Practice-VA (Clinical Pharmacy) [TH]	3	Pharm-482	Pharmacy Practice-VB(Clinical Pharmacy) [TH]	3
Pharm-473	Pharmacy Practice-VA (Clinical Pharmacy) [LAB]	1	Pharm-483	Pharmacy Practice-VB (Clinical Pharmacy) [LAB]	1
Pharm-474	Pharmaceutics-IVA (Industrial Pharmacy) [TH]	3	Pharm-484	Pharmaceutics-IVB (Industrial Pharmacy) [TH]	3
Pharm-475	Pharmaceutics-IVA (Industrial Pharmacy) [LAB]	1	Pharm485	Pharmaceutics-IVB (Industrial Pharmacy) [LAB]	1
Pharm-476	Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics) [TH]	3	Pharm-486	Pharmaceutics-VB (Biopharmaceutics & Pharmacokinetics) [TH]	3
Pharm-477	Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics) [LAB]	1	Pharm-487	Pharmaceutics-VB (Biopharmaceutics & Pharmacokinetics) [LAB]	1
Pharm-478	Pharmaceutics-VIA (Pharmaceutical Quality Management) [TH]	3	Pharm-488	Pharmaceutics-VIB (Pharmaceutical Quality Management) [TH]	3
Pharm-479	Pharmaceutics-VIA (Pharmaceutical Quality Management) [LAB]	1	Pharm-489	Pharmaceutics-VIB (Pharmaceutical Quality Management) [LAB]	1
	Total Cr. Hr. 19			**Total Cr. Hr. 19**	

5th Professional Pharm. D

9th Semester			10th Semester		
Course No.	**Subject**	**Cr. Hr.**	**Course No.**	**Subject**	**Cr. Hr.**
Pharm-591	Pharmaceutics-VIIA (Pharmaceutical Technology) [TH]	3	Pharm-5101	Pharmaceutics-VIIB (Pharmaceutical Technology) [TH]	3
Pharm-592	Pharmaceutics-VIIA (Pharmaceutical Technology) [LAB]	1	Pharm-5102	Pharmaceutics-VIIB (Pharmaceutical Technology) [LAB]	1
Pharm-593	Pharmacy Practice-VIA (Advanced Clinical Pharmacy) [TH]	3	Pharm-5103	Pharmacy Practice-VIB (Advanced Clinical Pharmacy) [TH]	3
Pharm-594	Pharmacy Practice-VIA (Advanced Clinical Pharmacy) [LAB]	1	Pharm-5104	Pharmacy Practice-VIB (Advanced Clinical Pharmacy) [LAB]	1
Pharm-595	Pharmacy Practice-VIIA (Forensic Pharmacy) [TH]	3	Pharm-5105	Pharmacy Practice-VIIB (Forensic Pharmacy) [TH]	3
Pharm-596	Pharmacy Practice-VIIIA (Pharmaceutical Management & Marketing) [TH]	3	Pharm-5106	Pharmacy Practice-VIIIB (Pharmaceutical Management & Marketing) [TH]	3
Pharm-597	Pharmaceutical Chemistry-IVA (Medicinal Chemistry) [TH]	3	Pharm-5107	Pharmaceutical Chemistry-IVB (Medicinal Chemistry) [TH]	3
Pharm-598	Pharmaceutical Chemistry-IVA (Medicinal Chemistry) [LAB]	1	Pharm-5108	Pharmaceutical Chemistry-IVB (Medicinal Chemistry) [LAB]	1
	Total Cr. Hr.18			**Total Cr. Hr. 18**	

Pharm. D Five-Year Credit Hours Summary

Pharm. D	1st Semester	2nd Semester	Total
Professional	**Cr. Hr.**	**Cr. Hr.**	**Cr. Hr.**
1st	22	20	42
2nd	22	21	43
3rd	20	19	39
4th	19	19	38
5th (Final)	18	18	36
Total (Credit Hours)	**101**	**97**	**198**

NOTE:

1. One credit hour of practical means that there will be one practical class in a week that will be equal to 3 credit hours and one practical class will not be less than 3 hours.
2. External Evaluation of Practical examination will be conducted at the end of each semester.

FIRST PROFESSIONAL

FIRST SEMESTER

ENGLISH-A (FUNCTIONAL ENGLISH)

Pharm-111 Cr. Hr. 02

Objectives: Enhance language skills and develop critical thinking.

Course Contents:

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.

PHARMACEUTICS-IA (PHYSICAL PHARMACY) THEORY

Pharm-112 Cr. Hr. 03

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. DISPERSIONS:

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.

c. Suspensions: Type, Methods of Preparation, Properties, Suspending agents, their classification and stability.

PHARMACEUTICS-IA (PHYSICAL PHARMACY) PRACTICAL

Pharm-113 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Determination of Emulsion systems; Determination of particle size; Density, Specific Volume, Weights and Volumes of Liquids; Preparation of Buffer solutions and isotonic solution; Determination of %age composition of solutions by Specific Gravity method.

PHARMACEUTICAL CHEMISTRY-IA (ORGANIC) THEORY

Pharm-114 Cr. Hr. 03

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, Tautornerism of Carbonyl Compounds, Nomenclature of Organic Compounds.

2. **STEREOCHEMISTRY/ CONFORMATIONAL ANALYSIS:** Stereoisomerism, optical isomerism; Molecules with more than one chiral centre, 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:**

PHARMACEUTICAL CHEMISTRY-IA (ORGANIC) PRACTICAL

Pharm-115 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Organic analysis: Identification of unknown simple organic compounds.

PHARMACEUTICAL CHEMISTRY-IIA (BIOCHEMISTRY) THEORY

Pharm-116 Cr. Hr. 03

1. GENERAL INTRODUCTION AND BASIC BIOCHEMICAL PRINCIPLES:
Role of Pharmaceutical Biochemistry in the health profession. Nature of biochemical reactions.

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).

PHARMACEUTICAL CHEMISTRY-IIA (BIOCHEMISTRY) PRACTICAL

Pharm-117 Cr. Hr. 01

1. Qualitative analysis of: Carbohydrates, Amino acids, Peptides and Sugar, Uric acid, Proteins, Lipids and Sterols (Cholesterol). Bile salts, Billirubin, Analysis of Cholesterol and Creatinine in Blood.

2. Quantitative analysis of: Carbohydrates-Glucose (reducing sugar) and any other carbohydrate using Benedict and Anthrone method, Amino acids, Peptides and Proteins using Biuret and Ninhydrin (Spectrophotometric) method. Analysis of normal and abnormal components of Urine-Sugar, Uric acid, Billirubin, Cholesterol and Creatinine.

PHYSIOLOGY-A THEORY

Pharm-118 Cr. Hr. 03

Course Objective:
After the completion of this course the students should be able to describe all the basic physiological processes which are the basis of pathophysiology of various diseases and their ultimate link with pharmacology for their treatment.

1. BASIC CELL FUNCTIONS:

a. Chemical composition of the body: Atoms, Molecules, Ions, Free Radicals, Polar Molecules, Solutions, Classes of Organic Molecules

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.

e. Movement of Molecules across Cell Membranes: Diffusion, Mediated Transport Systems, Osmosis, Endocytosis and Exocytosis, Epithelial Transport.

2. BIOLOGICAL CONTROL SYSTEM:

a. Homeostatic Mechanisms and Cellular Communication: General Characteristics, Components of Homeostatic Control Systems, Intercellular Chemical Massengers, Processes Related to Homeostasis, Receptors, Single Transduction Pathways.

b. Neural Control Mechanisms: Structure and Maintenance of Neurons, Functional Classes of Neurons, Glial Cells, Neural Growth and Regeneration, Basic Principles of Electricity, The resting Membrane Potential, Graded Potentials and Action Potentials, Functional Anatomy of synapses, Activation of the Postsynaptic Cell, Synaptic Effectiveness, Neurotransmitters and Neuromodulators, Neuroeffector communication, Central Nervous System: Spinal Cord Central Nervous System: Brain, Peripheral Nervous System, Blood Supply, Blood-Brain Barrier Phenomenon, and Cerebrospinal fluid.

c. The Sensory Systems: Receptors, Neural Pathways in Sensory System, Association Cortex and Perceptual Processing, Primary Sensory Coding, Somatic Sensation, Visio, Hearing, Vestibular System, Chemical Senses.

d. Principles of Hormonal Control Systems: Hormone Structures and Synthesis, Hormone Transport in the Blood, Hormone Metabolism and Excretion, Mechanisms of Hormone Action, Inputs that control Hormone Secretion, Control Systems Involving the Hypothalamus and Pituitary, candidate Hormones, types of Endocrine Disorders.

e. Muscle: Structure, Molecular Mechanisms of Contraction, Mechanics of Single fiber Contraction, Skeletal Muscle Energy Metabolism, Types of Skeletal Muscle Fibers, Whole Muscle Contraction, Structure, Contraction and its Control.

f. Control of Body Movement: Motor Control Hierarchy, Local control of Motor Neurons, The Brain Motor Centers and the Descending Pathways they Control, Muscle Tone, Maintenance of Upright Posture and Balance, Walking.

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

NOTE: Special emphasis should be given on the normal physiological values and their changes during respective pathological conditions. Furthermore, the physiological link will be developed with pathology as well as pharmacology.

PHYSIOLOGY-A PRACTICAL

Pharm-119 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Experimental Physiology includes:

1. **NEURAL CONTROL MECHANISM:** Nerve muscle preparation in frog; Effect of Temperature on muscle and Demonstration of spinal reflexes.

2. **SENSORY SYSTEM:** Visual activity, far vision, near vision and Field of vision (Perimetry). Hearing and Vestibualr system.

ANATOMY & HISTOLOGY THEORY

Pharm-1110 Cr. Hr. 03

Course Objectives: After the completion of this course the students should be able to understand the basic structure of various organs of our body not only at gross level but also at tissues or cell level.

1. **INTRODUCTION:** ANATOMICAL TERMINOLOGY: Definition. Cell, tissue, organ system
2. **STRUCTURE OF CELL:** Cell Membrane, Cytoplasm, Organelles, Nucleus, Cell cycle.
3. **TISSUES OF BODY:**Types of tissues with examples,

a. Epithelial Tissue: General characters, classification.
b. Connective Tissue: Structure & types; (Connective tissue, Cartilage).
c. Bones: Structure and types of bones and joints.
d. Muscle: Structure of skeletal muscle, smooth muscle, cardiac muscle.

4. **INTEGUMENTARY SYSTEM:**

a. Skin: Structure (Epidermis, dermis).
b. Glands of Skin: (Sweat, Sebaceous).
c. Hair: Structure, function.
d. Nail: Structure, function

5. **CARDIOVASCULAR SYSTEM:**

a. Heart: Structure of Heart, Location of Heart, Blood Supply to Heart.
b. Blood Vessels: Main blood vessels arising & entering the heart. Types of blood vessels with examples.

6. **ALIMENTARY SYSTEM:** Name and structure of different parts of alimentary system and their inter-relationship.
7. **URINARY SYSTEM:** Name and structure of organs of urinary system and their inter-relationship.
8. **REPRODUCTIVE SYSTEM:** Male and Female reproductive systems. Name, structure and association of the organs.
9. **ENDOCRINE SYSTEM:**

a. Pituitary gland: structure and relation to hypothalamus.
b. Thyroid gland: structure.
c. Adrenal gland: structure.

10. **NERVOUS SYSTEM:** Introduction: Cells of Nervous System (Neuron), Accessory cells of N.S. and Organization of N.S.

a. Brain: Meninges (Cerebrum: cerebral Lobes. Ventricals, Cerebellum—Anatomy of Cerebellum, Brain Stem: MidBrain. Pons. MEdulla Oblongata, Diencephalon. Thalamus Hypothalamus and Cranial Nerves).
b. Spinal Cord: Meninges (C.S.F. Internal Structure, Sensory and Motor Pathway, Spinal Reflexes, Peripheral spinal Nerves, Autonomic Nervous System includes Sympathetic N.S. and Parasympathetic Nervous System).

11. **HISTOLOGY:**

a. Underlying principles of histological techniques and staining specific tissues should be explained.
b. Staining of paraffin and frozen sections will be given to the students.
c. Most of the teaching should be done on stained and mounted sections and every type of normal tissue will be covered.

ANATOMY & HISTOLOGY PRACTICAL

Pharm-1111 Cr. Hr. 01

1. Demonstration of the Preparation and staining of slides**.**
2. Histological examination of slides: Epithelium, Muscle tissue and Connective tissue.
3. Organ system: Lung, Kidney, Stomach, Appendix, Skin, Intestine and Gall bladder.

FIRST PROFESSIONAL

SECOND SEMESTER

ENGLISH-B (COMMUNICATION, TECHNICAL WRITING & PRESENTATION SKILLS)

Pharm-121 Cr. Hr. 04

Course Objectives: Enable the students to meet their real life communication needs, enhance language skills and develop critical thinking.

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.
Technical Report writing: Pharmacy writing and oral communication.

NOTE: Documentaries to be shown for discussion and review. Extensive reading is required for vocabulary building.

PHARMACEUTICS-IB (PHYSICAL PHARMACY) THEORY

Pharm-122 Cr. Hr. 03

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, lyophillization, 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:

a. Physical Factors: Influence of pH, temperature, ionic strength, acid-base catalysis, U.V. light.

b. Chemical Factors: Complex chemical reactions, Oxidation-reduction reactions, Hydrolysis.

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Determination of Emulsion systems; Determination of particle size; Density, Specific Volume, Weights and Volumes of Liquids; Preparation of Buffer solutions and isotonic solution; Determination of %age composition of solutions by Specific Gravity method.

PHARMACEUTICS-IB (PHYSICAL PHARMACY) PRACTICAL

Pharm-123 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g.

a. Partition-coefficient, surface tension, viscosity.

b. Experiments to demonstrate some of physico-chemical processes like simple distillation, steam distillation, crystallization, dialysis.

PHARMACEUTICAL CHEMISTRY-IB (ORGANIC) THEORY

Pharm-124 Cr. Hr. 03

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 RE-ARRANGEMENTS:** Pinacol-Pinacolone, Wagner-Meerwein, Wolff, Hofmann and Beckmann rearrangements.

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

PHARMACEUTICAL CHEMISTRY-IB (ORGANIC) PRACTICAL

Pharm-125 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Organic Preparations: Benzoic acid, Aspirin, Acetanilide, Iodoform, Nitrophenol, 3-nitrophthalic acid, Benzhydrol and 2,4-Dinitrochlorobenzene.

PHARMACEUTICAL CHEMISTRY-IIB (BIOCHEMISTRY) THEORY

Pharm-126 Cr. Hr. 03

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.

PHARMACEUTICAL CHEMISTRY-IIB (BIOCHEMISTRY) PRACTICAL

Pharm-127 Cr. Hr. 01

1. Qualitative analysis of: Carbohydrates, Amino acids, Peptides and Sugar, Uric acid, Proteins, Lipids and Sterols (Cholesterol), Bile salts, Billirubin, Analysis of Cholesterol and Creatinine in Blood.

2. Quantitative analysis of: Carbohydrates-Glucose (reducing sugar) and any other carbohydrate using Benedict and Anthrone method, Amino acids, Peptides and Proteins using Biuret and Ninhydrin (Spectrophotometric) method. Analysis of normal & abnormal components of Urine-Sugar, Uric acid, Billirubin, Cholesterol and Creatinine.

PHYSIOLOGY-B THEORY

Pharm-128 Cr. Hr. 03

Coordinated Body Functions:

a. Circulation: Plasma, the Blood Cell, Pressure, flow and resistance, Anatomy, Heartbeat coordination, Mechanical Events of the Cardiac Cycle, The Cardiac output, Measurement of Cardiac Function, Arteries, Arterioles, Capillaries, veins, The Lymphatic system, Baroreceptor Reflexes, Blood Volume and Long term Regulation of Arterial Pressure, Other Cardiovascular Reflexes and Responses, Hemorrhage and Other Causes of Hypotension, the Upright Posture, Exercise, Hypertension, Heart Failure, Coronary Artery Disease and Heart Attacks, Formation of Platelet Plug, Blood coagulation: Clot Formation, Anticlotting systems, Anticlotting Drugs.

b. Respiration: Organization of the Respiratory System, Ventilation and Lung Mechanics, Exchange of Gases in Alveoli and tissues, Transport of Oxygen in Blood, Transport of Carbon dioxide in Blood, Transport of Hydrogen ions between Tissues and Lungs, Control of Respiration, Hypoxia, Nonrespiratory functions of the Lungs.

c. The kidneys and Regulation of Water and Inorganic Ions: Renal Functions, Structure of the Kidneys and Urinary System, Basic Renal Process, The Concept of Renal Clearance Micturition, Total Body Balance of sodium and Water Basic Renal Process for sodium and Water, Renal Sodium Regulation, Renal Water regulation, A Summary Example: the response to Sweating, Thirst and Salt Appetite, Potassium Regulation, Effector Sites for Calcium Homeostasis, Hormonal controls, Metabolic Bone Disease, Source of Hydrogen Ion gain or loss, Buffering of Hydrogen Ions in the Body, Integration of Homeostatic Controls, Renal Mechanisms, Classification of Acidosis and Alkalosis, Diuretics, Kidney Disease.

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.

e. Regulation of Organic Metabolism, Growth and Energy Balance: Events of the Absorptive and Postabsorptive States, Endocrine and Neural Control of the Absorptive and Postabsorptive States, Fuel Homeostasis in Exercise and Stress Diabetes Mellitus, Hypoglycemia as a Cause of Symptoms, Regulation of
Plasma Cholesterol, Bone Growth, Environmental Factors, Influencing Growth, Hormonal Influences on Growth, compensatory Growth, Basic Concepts of Energy Expenditure, Regulation of Total Body Energy Stores, Regulation of Body Temperature.

f. Reproduction: General Principles of Gametogenesis, Anatomy, Spermatogenesis, Transport of Sperm, Hormonal control of Male Reproductive Functions, Ovarian Function, Control of Ovarian Function, Uterine Changes in the Menstrual Cycle, Other Effects of Estrogen and Progesterone, Androgens in Women, Female Sexual Response, Pregnancy, Sex Determination, Sex Differentiation, Puberty, Menopause.

g. Defense Mechanisms of the Body: Cells Mediating Immune Defenses, Nonspecific Immune Defenses, Specific Immune Defenses, Systemic Manifestations of Infection Factors that Alter the Body's Resistance to Infection, Harmful Immune Responses, Absorption, Storage Sites, Excretion, Biotransformation, Functions of Cortisol in Stress, Functions of the Sympathetic Nervous System in Stress, Other Hormones Released During Stress Psychological Stress and Disease.

NOTE: Special emphases should be given on the normal physiological values and their changes during respective pathological conditions. Furthermore, the physiological link will be developed with pathology as well as pharmacology.

PHYSIOLOGY-B PRACTICAL

Pharm-129 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Experimental Physiology includes;

1. BLOOD: Determination of Haemoglobin (Hb), Determination of ESR, RBC Count, WBC Count, DLC (Differential Leucocyte Count), Bleeding Time, Coagulation Time and Blood groups.

2. RESPIRATION: Estimation of vital capacity and its relation to posture and standard vital capacity, Determination of Tidal volume and Demonstration of Artificial Respiration.

3. CARDIOVASCULAR SYSTEM: Recording of Arterial Pulse, Recording of Arterial Blood Pressure and Electro-cardiogram.

SECOND PROFESSIONAL

THIRD SEMESTER

ISLAMIC STUDIES

Pharm-231 Cr. Hr. 03

Course Objectives: This course is aimed at;
1. To provide Basic information about Islamic Studies
2. To enhance understanding of the students regarding Islamic Civilization
3. To improve Students skill to perform prayers and other worships
4. To enhance the skill of the students for understanding of issues Related to faith and religious life.

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:
1. Verses of Surah Al-Baqra Related to Faith (Verse No. 284-286).
2. Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No. 1-18).
3. Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No. 1-11).
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

PHARMACEUTICS-IIA (DOSAGE FORM SCIENCES) THEORY

Pharm-232 Cr. Hr. 03

1. PHARMACEUTICAL CALCULATIONS: Some Fundamentals of Measurements and Calculations. The Metric System. The Common Systems. Conversions. Calculation of Doses. Percentage calculations, Reducing and Enlarging Formulas. Weights and Volumes of Liquids. HLB Values. Industrial Calculations. Calculations involving parenteral admixtures. Some calculations involving Hydrogen-ion concentration. Calculations involving isotonic, electrolyte and buffer solutions.

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

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

4. SOLVENTS USED IN PHARMACEUTICAL PREPARATIONS:

5. ORAL SOLUTIONS, SYRUPS, ELIXIRS AND SPIRITS: Solutions: their preparation, dry mixtures for solution, oral rehydrate solutions, oral colonic lavage solution. Syrup: components and preparation of syrups. Elixirs: Preparation of elixirs, Medicated and non-Medicated elixirs. Spirits: Preparation of Spirits.

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

7. TOPICAL AND TRANSDERMAL DRUG DELIVERY SYSTEMS: Introduction of Ointments, Creams, Pastes, Poultice, Plasters, Lotions, Liniments, Topical gels, Topical Tinctures, Collodions, Topical solutions, Topical powders, Percutaneous absorption, Transdermal systems in use.

8. OPHTHALMIC, NASAL AND OTIC PREPARATIONS: Ophthalmic solutions, suspensions, ointment, inserts, contact lens solutions. Nasal decongestant solutions, Decongestant inhalers. Ear preparations: Anti-infective, anti-inflammatory and analgesic.

PHARMACEUTICS-IIA (DOSAGE FORM SCIENCES) PRACTICAL

Pharm-233 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Prepartion of simple syrup, Orange syrup, Ferrous sulphate syrup, Cod Liver oil Emulsion, Liquid paraffin Emulsion, Throat paint (Mandle's paint), Boroglycerine glycerite, Tannic acid glycerin, Spirit ammonia aromatic, Spirit of Ethyl Nitrite. Preparation of Methyl salicylate ointment, Sulphur ointment, Calamine lotion, Iodine tincture, Preparations of oral hygiene products, Poultice of Kaolin, Effervescent granules, Distilled Water for Injections (A minimum of 10 practicals will be conducted).

PHARMACEUTICS-IIIA (PHARMACEUTICAL MICROBIOLOGY & IMMUNOLOGY) THEORY

Pharm-234 Cr. Hr. 03

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

1. **GENERAL MICROBIOLOGY:** Historical Introduction, Scope of Microbiology with special reference to Pharmaceutical Sciences. Nomenclature and classification of Micro-organisms.

2. **MICRO-ORGANISMS:**

a) The Bacteria: General and cellular Morphology, structure and function. Classification of Bacteria. Growth curve, growth factors and growth characteristics. Nutrition Requirements and Nutrition factors affecting growth. Culture Media, Bacterial cultures and staining methods.

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 inhibitants of air, water and soil).

(b) Normal flora of Skin, Intestinal tract, Ear, Nose etc.

PHARMACEUTICS-IIIA (PHARMACEUTICAL MICROBIOLOGY & IMMUNOLOGY) PRACTICAL

Pharm-235 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Sterilization of Glassware and pharmaceutical products by various methods. Microbiological assays of antibiotics and vitamins. Preparation of general and selective Media and culturing of microorganisms. Total and viable counts of micro-organism. Morphological and selective biochemical characterization of some specimen. Staining of Bacteria: Gram method, Acid fast, Giemasas staining, Capsule staining, Flagella staining and Spore staining. Microbiological analysis of air, water and soil (Note: A minimum of 10 practicals will be conducted).

PHARMACOLOGY & THERAPEUTICS-IA THEORY

Pharm-236 Cr. Hr. 03

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 (t1/2β) 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.
d. Sympathetic antagonists: Adrenergic receptor Blockers and neuron blockers.
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

NOTE:

1. Only an introduction will be given of the banned and obsolete drug products.
2. 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.
3. 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.
4. The prototype drugs in each group from the latest edition of the recommended books.

PHARMACOLOGY & THERAPEUTICS-IA PRACTICAL

Pharm-237 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the theoretical topics and availability of the facilities e.g. 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's heart. To demonstrate the effects of parasympathomimetic (Acetylcholine) and parasympatholytic (Atropine) drugs on Frog's heart. To demonstrate the effects of an unknown drug on Frog's heart. Routes of Administration of drugs. To demonstate the effects of vasconstrictor 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 effects 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 Homatropine on Rabbit's Eyes. To study the effects of Pilocarpine 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. To demonstrate emetic effects of various drugs in pigeons (Note: A minimum of 10 practicals will be conducted).

PHARMACOGNOSY-IA (BASIC) THEORY

Pharm-238 Cr. Hr. 03

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.

2. Crude Drugs: Preparation of crude drugs for commercial market. Chemical and Therapeutic classisification of crude drugs (Official & Un-official drugs). Methods of Cultivation, Drying, Storage, Preservation and Packing.

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

S. No.	Families	Crude Drugs
a.	Ranunculaceae	*Aconitum, Larkspur, Pulsatilla, Hydrastis*
b.	Papaveraceae	*Papaver somniferum, Sanguinaria, Canadensis*
c.	Leguminosae	*Acacia, Glycyrrhiza, Senna, Cassia, Tamarind*
d.	Umbelliferae	*Fennel, Carum, Coriander, Conium, Asafoetida*
e.	Apocynaceae	*Rauwolfia, Catharanthus*
f.	Asclepiadaceae	*Gymnema sylvestre, Calotropis gigantea*
g.	Compositae	*Artemisia, Silybum marianum, Echinaceae, Arctium lappa*
h.	Solanaceae	*Belladonna, Hyoscyamus, Stramonium, Capsicum*
i.	Scrophulariaceae	*Digitalis, Verbascum (Mullien)*
j.	Labiatae	*Peppermint, Thyme, Spearmint, Salvia, Ocimum*
k.	Liliaceae	*Garlic, Colchicum, Aloe*
l.	Zingiberaceae	*Ginger, Curcuma*

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.

PHARMACOGNOSY-IA (BASIC) PRACTICAL

Pharm-239 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters). Microscopic examination of powders and sections of plant drugs.
(Note: A minimum of 10 practicals will be conducted).
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 the country.

PHARMACY PRACTICE-IA (PHARMCEUTICAL MATHEMATICS)

PRACTICAL

Pharm-2310 Cr. Hr. 03

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.

4. **DIFFERENTIAL CALCULUS:** Functions, variations in functions, limits, differential coefficient, differentiation of algebraic, trigonometric, exponential and logarithmic functions, partial derivatives. Maxima and minima values. Points of inflexion.

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

SECOND PROFESSIONAL

FOURTH SEMESTER

PAKISTAN STUDIES

Pharm-241 Cr. Hr. 02

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

PHARMACEUTICS-IIB (DOSAGE FORM SCIENCES) THEORY

Pharm-242 Cr. Hr. 03

1. SUPPOSITORIES AND ENEMAS: Semi-solid preparations, Suppositories: Bases, preparation, packaging and storage, Solutions/Enemas: preparation, packing & storage.

2. AEROSOLS, INHALATIONS AND SPRAYS: Aerosol: Principle, container and valve assembly, propellants, filling, testing, packaging, labelling and storage. Inhalations: Principle, container and valve assembly, propellants, filling, testing, packaging, labelling and storage. Sprays: Principle, container and valve assembly, propellants, filling, testing, packaging, labelling and storage.

3. POWDERS, CAPSULES, TABLET DOSAGE FORMS: Preparation of Powders, mixing of powders, uses and packaging of powders, granules, effervescent granulated salts. Hard gelatin capsules: capsule sizes, preparation of filled hard gelatin capsules. Soft gelatin capsules, preparation and its application. Tablets: types, characteristics and methods of preparation.

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

5. A BRIEF INTRODUCTION TO ORAL HYGIENE PRODUCTS:

PHARMACEUTICS-IIB (DOSAGE FORM SCIENCES) PRACTICAL

Pharm-243 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities. (A minimum of 10 practicals will be conducted).

PHARMACEUTICS-IIIB (PHARMCEUTICAL MICROBIOLOGY & IMMUNOLOGY) THEORY

Pharm-244 Cr. Hr. 03

1. **INDUSTRIAL MICROBIOLOGY:** Introduction to Sterilization/ Disinfection. Fermentation. Pharmaceutical products produced by fermentation process (Penicillins, Cepalosporins, Gentamycin, Erythromycin, Tetracyclines, Rifamycin, Griseofulvin).

2. **IMMUNOLOGY:** Introduction and types of Immunity: Specific and non-specific (Cellular basis of Immune response. Immunity, autoimmunity, tolerance. Antigen. Anti-bodies). Antigen-Antibody reactions and their clinical and diagnostic applications. Hypersensitivity and allergy. Drug allergy mechanism. Vaccination: Introduction and aims. Types of Vaccines. Current vaccine practices.

3. **FACTORY & HOSPITAL HYGIENE including GOOD MANUFACTURING PRACTICES:** Introduction, Control of Microbial contamination during manufacture. Manufacture of Sterile products, A Guide to Current Good Pharmaceutical Manufacturing Practices.

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

PHARMACEUTICS-IIIB (PHARMCEUTICAL MICROBIOLOGY & IMMUNOLOGY) PRACTICAL

Pharm-245 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Sterilization of Glassware and pharmaceutical products by various methods. Microbiological assays of: Anti-biotics and vitamins. Preparation of general and selective Media and culturing of microorganisms. Total and viable counts of micro-organism. Morphological and selective biochemical characterization of some specimen. Staining of Bacteria: Gram method, Acid fast, Giemasas staining, Capsule staining, Flagella staining and Spore staining. Microbiological analysis of air, water and soil (Note: A minimum of 10 practicals will be conducted).

PHARMACOLOGY & THERAPEUTICS-IB THEORY

Pharm-246 Cr. Hr. 03

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
b. Congestive heart failure & its treatment.
c. Anti-arrhythmic drugs
d. Anti-hyperlipidemic.
e. Coagulants and Anti-coagulants
f. Anti-hypertensive
g. Diuretics

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.

NOTE:
1. Only an introduction will be given of the banned and obsolete drug products.
2. 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.
3. 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.
4. The prototype drugs in each group from the latest edition of the recommended books.

PHARMACOLOGY & THERAPEUTICS-IB PRACTICAL

Pharm-247 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g.
1. Preparation of standard solution, Ringer solution,Tyrode solution, Kreb solution, Normal saline solution.
2. To demonstrate the effects of sympathomimetic (Adrenaline) &sympatholytic drugs (Propranolol) on Frog's heart.
3. To demonstrate the effects of parasympathomimetic (Acetylcholine) and parasympatholytic (Atropine) drugs on Frog's heart.
4. To demonstrate the effects of an unknown drug on Frog's heart.

5. Routes of Administration of drugs.
6. To demonstate the effects of vasconstrictor drugs on Frog's blood vessels.
7. To demonstrate the effects of stimulant drugs on Rabbit's intestine (Acetyl choline, Barium chloride).
8. To demonstrate the effects of depressant drugs on Rabbit's intestine (Atropine).
9. To differentiate the effects of an unknown drug on Rabbit's intestine and identify the (unknown) drug.
10. To study the effects of Adrenaline on Rabbit's Eyes.
11. To study the effects of Homatropine on Rabbit's Eyes.
12. To study the effects of Pilocarpine on Rabbit's Eyes.
13. To study the effects of Local Anaesthetic drug (e.g Cocaine) on Rabbit's Eyes.
14. To identify the unknown drug & differentiate its effects on Rabbit's Eyes

(Note: A minimum of 10 practicals will be conducted).

PHARMACOGNOSY-IB (BASIC) THEORY

Pharm-248 Cr. Hr. 03

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.

7. ENZYMES: Enzymes obtained from plant source. (Phytoenzymes). Papain, Bromelain and Malt Extract. Enzymes obtained from Animal source. Rennin, pepsin, Pancreatin and Pancrealipase.

PHARMACOGNOSY-IB (BASIC) PRACTICAL

Pharm-249 Cr. Hr. 01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters), Microscopic examination of powders and sections of plant drugs.
(Note: A minimum of 10 practicals will be conducted).

NOTE: 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 the country.

PHARMACY PRACTICE-IB (BIOSTATISTICS) PRACTICAL

Pharm-2410 Cr. Hr. 01

1. DESCRIPTION OF STATISTICS: Descriptive Statistics: What is Statistics? Importance of Statistics. What is Biostatistics? Application of Statistics in Biological and Pharmaceutical Sciences. How samples are selected?

2. ORGANIZING and DISPLAYING DATA: Vriables, 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.

THIRD PROFESSIONAL

FIFTH SEMESTER

PHARMACYPRACTICE-IIA (DESPESING PHARMACY) THEORY

Pharm-351 Cr. Hr. 03

1. BASIC PRINCIPLES OF COMPOUNDING AND DISPENSING INCLUDING: Fundamental operations in Compounding, Containers and closures for Dispensed Products, Prescription-Handling (Parts of Prescription, Filling, Interpretation, Pricing) and Labelling of Dispensed Medication.

2. EXTEMPORANEOUS DISPENSING OF: Solutions, Suspensions, Emulsions, Creams, Ointments, Pastes and gels, Suppositories and pessaries, Powders and granules and Oral unit dosage form.

3. PHARMACEUTICAL INCOMPATIBILITIES: Types of Incompatibilities, Manifestations, Correction and Prevention with reference to typical examples.

PHARMACYPRACTICE-IIA (DESPESING PHARMACY) PRACTICAL

Pharm-352 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Practical introduction to prescription handling, interpretation, filling and labeling.

Mixtures: Dispensing of simple mixtures containing soluble substances only, mixtures containing diffusible substances, in-diffusible substances and mixtures forming precipitate.

Powders: Dispensing of simple powders, compound powders and effervescent powders for external use.

Incompatibility: Practical importance of Incompatibilities**.**

Ointments and Creams: Dispensing of iodine and Methyl salicylate ointment. Dispensing of cold cream and vanishing creams.

Cosmetics: Lipstick, talcum powder, after shave lotion, shaving cream.(Note: A minimum of 20 practicals will be conducted).

Health Science Research Project: In the area of health care system, community pharmacy. Establishment of DIC, PCC.

PHARMACEUTICAL CHEMISTRY-IIIA (PHARMACEUTICAL ANALYSIS) THEORY

Pharm-353 Cr. Hr. 03

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.

PHARMACEUTICAL CHEMISTRY-IIIA (PHARMACEUTICAL ANALYSIS) PRACTICAL

Pharm-354 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. determination of the purity and composition of the unknown drugs by using at least each of the above techniques. (A minimum of 10 practicals will be conducted).

PHARMACOLOGY & THERAPEUTICS-IIA THEORY

Pharm-355 Cr. Hr. 03

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

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

PHARMACOLOGY & THERAPEUTICS-IIA PRACTICAL

Pharm-356 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the abovementioned theoretical topics and availability of the facilities, e.g.

1. To study the convulsant effects of strychnine and picrotoxin in frogs and to determine the site of action.
2. To identify the unknown (convulsant) drug and determine its site of action.
3. To study the effects of Adrenaline on Human Eyes.
4. To study the effects of Pilocarpine on Human Eyes.
5. To study the effect of Homatropine on Human Eyes.
6. To identify and observe the effects of unknown drugs on Human Eyes.
7. To study the effects of local anaesthetic drugs on human and the nerve plexus of frog.
8. To identify and differentiate the effects of unknown drug on human and the nerve plexus of frog.
9. To demonstrate the effects of Acetylcholine on the Rectus abdominus muscle of frog and competitive pharmacological antagonism by Neuromuscular blocking agent e.g. Gallamine.
10. To identify the unknown drug by performing pharmacological competitive antagonism on Rectus abdominus muscle of Frog.
11. To study the anti-coagulant effects of Heparin and oral anti-coagulants on Rabbits.
12. To identify the unknown anticoagulant drug using Rabbits.
13. To demonstrate the Graded Dose-Response curve of Acetylcholine on Rabbit intestine.
14. To identify unknown concentration of Acetycholine from Graded Dose-Response curves.
15. To demonstrate the general anesthetic effect on rabbits.
16. To demonstrate the effect of sedatives and hypnotics on rabbits.
17. To demonstrate the anti-nociceptive (analagesic) effect on mice.
18. To demonstrate antidepressant effect in rats (forced swimming test, tail suspension test, Yohimbine lethality test).

(Note: A minimum of 10 practicals should be conducted).

PHARMACOGNOSY-IIA (ADVANCE) THEORY

Pharm-357 Cr. Hr. 03

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, Cassification, Function of alkaloids in plants, Methods of extraction and identification tests.
a. Pyridine-Piperidine Alkaloids: Areca nut, Lobelia.
b. Tropane Alkaloids: Belladonna, Hyoscyamus, Stramonium.
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.

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

7. **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.

PHARMACOGNOSY-IIA (ADVANCE) PRACTICAL

Pharm-358 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Extraction of the active constituents of crude drugs and chemical tests for their identification. Isolation and separation of active constituents of crude drugs by paper and thin layer chromatography.

Also include the following experiments:

Determination of Iodine value; Saponification value and unsaponifiable matter; ester value; Acid value.

Chemical tests for Acacia; Tragacanth; Agar; Starch; Lipids. (castor oil, sesame oil, shark liver oil,bees wax); Gelatin.

(Note: A minimum of 10 practicals will be conducted)

PATHOLOGY THEORY

Pharm-359 Cr. Hr. 03

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

2. **DEFINITION AND TERMINOLOGY:**Ischemia, Hypoxia, Necrosis, sInfarction, 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.

PATHOLOGY PRACTICAL

Pharm-3510 Cr. Hr. 01

1. STUDY OF PATHOLOGICAL SLIDES OF VARIOUS PATHOLOGICAL CONDITIONS:

Acute inflammation, Chronic inflammation, Chronic specific inflammation, Different types of Degeneration, Thrombosis, Embolism, Infarction, Necrosis, Gangrene, Hyperplasia, Metaplasia, Pigmentation, Calcification, CVC, Papilloma, Adenoma, Chondroma, Fibroma, Leomyoma, Neofibroma, Squamous Cell Carcinoma, Basal Cell Carcinoma, Transitional Cell Carcinoma, Adenocarcinoma, Fibrocarcinoma, Rhadomyo sarcoma, Leomyo sarcoma, Lymphosarcoma, Liposarcoma, Reticular Cell Sarcoma, Hodgkins disease, Breast Carcinoma, Osteogenic Sarcoma, Osteoclastoma, Hapatitis, Diabetes.

2. EXAMINATION OF DIFFERENT BODY FLUIDS IN VARIOUS PATHOLOGICAL CONDITIONS:

Urine Complete Examination, Stool Examination, Blood Complete Examination, Semen Examination, Cerebrospinal Fluid Examination, Pericardial Fluid Examination, Pleural Fluid Examination, Ascitic Fluid Examination, Blood Sugar, Blood Urea, Blood Cholesterol etc.

3. TESTS FOR VARIOUS SPECIMENS OF CLINICAL IMPORTANCE:

Techniques of Clinical Blood Examination for various disases, Gastric Analysis, Tests for liver function, Renal function test, Tests for endocrine abnormalities, Biopsies and cytologic techniques.

THIRD PROFESSIONAL

SIXTH SEMESTER

PHARMACY PRACTICE-IIB (COMMUNITY, SOCIAL & ADMINISTRATIVE PHARMACY) THEORY

Pharm-361 Cr. Hr. 03

1. **DEFINITIONS AND BACKGROUND:**

2. **PUBLIC HEALTH AND COMMUNITY PHARMACY:** Epidemiology & its Control, Epidemiological methodology with a focus on specific disease states, Pharmacoepidemiology (including Drug Utilization Review). Preventive Health (EPI & CDC), Family Planning and Health Policy.

3. **MEDICAL COMPLICATION OF DRUG TAKING:** General and Socio-economic aspects.

4. **PATIENT EDUCATION AND COUNSELLING:**

5. **CONTROL OF DRUG ABUSE AND MISUSE:**

6. **ROLE OF PHARMACIST:** As Public Health Educator in the Community for Drug Monitoring and Drug Information.

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.

10. **PHARMACY LAYOUT DESIGN:** Objectives of Layout Design, Types of Community Pharmacies (Pharmaceutical Centre, Prescription-oriented Pharmacies, Traditional Pharmacies and The Super Drug Store), Consumer goods and purchases, Classes of Layout designs, Principles and characteristics of Layout Design and Traffic Flow analysis.

PHARMACEUTICAL CHEMISTRY-IIIB (PHARMACEUTICAL ANALYSIS) THEORY

Pharm-362 Cr. Hr. 03

1. **ELECTRO CHEMICAL METHODS:** Potentiometry, Polarography and Radiochemical Techniques.

2. **THERMAL ANALYSIS:**
Differential Scanning Calorimetry, Differential Thermal Analysis, Thermo Gravimetric Analysis**.**
3. **TITRIMETRIC ANALYSIS:** Titrimetric analysis of drugs based on neutralization, hydrolysis, oxidation, reduction and non-aqueous titration.

4. **OCCURENCE, 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.

PHARMACEUTICAL CHEMISTRY-IIIA (ANALYTICAL CHEMISTRY) PRACTICAL

Pharm-363 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. determination of the purity and composition of the unknown drugs by using at least each of the above techniques. (A minimum of 10 practicals will be conducted).

PHARMACOLOGY & THERAPEUTICS-IIB THEORY

Pharm-364 Cr. Hr. 03

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, Calciumdisodium 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.

PHARMACOLOGY & THERAPEUTICS-IIB PRACTICAL

Pharm-365 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g.

1. To study the convulsant effects of strychnine and picrotoxin in frogs and to determine the site of action.

2. To identify the unknown (convulsant) drug and determine its site of action.

3. To study the effects of Adrenaline on Human Eyes.

4. To study the effects of Pilocarpine on Human Eyes.

5. To study the effect of Homatropine on Human Eyes.

6. To identify and observe the effects of unknown drugs on Human Eyes.

7. To study the effects of local anaesthetic drugs on human and the nerve plexus of frog.

8. To identify and differentiate the effects of unknown drug on human and the nerve plexus of frog.

9. To demonstrate the effects of Acetylcholine on the Rectus abdominus muscle of frog and competitive pharmacological antagonism by Neuromuscular blocking agent e.g. Gallamine.
10. To identify the unknown drug by performing pharmacological competitive antagonism on Rectus abdominus muscle of Frog.
11. To study the anti-coagulant effects of Heparin and oral anti-coagulants on Rabbits.
12. To identify the unknown anticoagulant drug using Rabbits.
13. To demonstrate the Graded Dose-Response curve of Acetylcholine on Rabbit intestine.
14. To identify unknown concentration of Acetycholine from Graded Dose-Response curves.
15. To demonstrate the general anesthetic effect on rabbits.
16. To demonstrate the effect of sedatives and hypnotics on rabbits .
17. To demonstrate the anti-nociceptive (analagesic) effect on mice.
18. To demonstrate antidepressant effect in rats (forced swimming test, tail suspension test, Yohimbin lethality test).
(Note: A minimum of 10 practicals should be conducted)

PHARMACOGNOSY-IIB (ADVANCE) THEORY

Pharm-366 Cr. Hr. 03

1. **VOLATILE OILS (ESSENTIAL OILS):** Introduction, significance, sources, active constituents, methods of obtaining volatile oils, chemistry and classification of:
(a) Hydrocarbon volatile oils: Cubeb 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 (apiol, safrole, myristicin), Monoterpene (thujone, menthafuran) Plant acids (oxalic acid, amino acid, resin acid), Glycosides (cardiotonic, cyanognic), Alkaloids (imidazole, pyrrolizidine, tropane).
c) Lower Plant Toxins: Bacterial toxins (Staphylococcus aureus, Clostridium botulinum), Algal toxins (Microcystis aeruginosa, Cyanobecteria, 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 tabaccum, 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, Momordicacharantia, 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, Phycotis ajowan, Trigonella foenum--graecum, Zingiber officinale.*
Renal disorders:*Cucumis melo, Berberis vulgaris, Zea mays, Tribulus terrestris.*
Reproductive disorders:*Saraca indica, Ruta graveolens, Nigella sativa, Glycyrrhiza glabra, Claviceps purpurea, Myristica fragrance.*
G.I.T. disorders:*Foeniculum vulgare, Ferula foetida, Cuminum cyminum, Aegle marmelos, Prunus domestica.*

PHARMACOGNOSY-IIA (ADVANCE) PRACTICAL

Pharm-367 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. extraction of the active constituents of crude drugs and chemical tests for their identification. Isolation and separation of active constituents of crude drugs by paper chromatography and thin layer chromatography.

Also include the following experiments:

- Determination of Iodine value; Saponification value and unsaponifiable matter; ester value; acid value.
- Chemical tests for Acacia; Tragacanth; Agar; Starch; Lipids. (castor oil, sesame oil, shark liver oil, bees wax); Gelatin.

(Note: A minimum of 10 practicals will be conducted).

PHARMACY PRACTICE-III (COMPUTER & ITS APPLICATIONS IN PHARMACY) THEORY

Pharm-368 Cr. Hr. 03

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

8. **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.

PHARMACY PRACTICE-III (COMPUTER & ITS APPLICATIONS IN PHARMACY) PRACTICAL

Pharm-369 Cr. Hr. 01

1. **INTERNET AND E-MAIL**: Internet and Microsoft Internet Explorer 5, Addresses, Links and Downloading, Searching the Internet, E-mail and Newsgroups, Favourites, security and Customizing Explorer.

2. **WEB PAGE DEVELOPMENT**: 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.

3. **DATA PRESENTATION SKILLS**: MS-Word, MS-Excel, MS-Power point.

4. **UNDERSTANDING AND APPLICATION OF STATISTICAL PACKAGES:** SPSS, Kinetica, Med Calc.

FOURTH PROFESSIONAL

SEVENTH SEMESTER

PHARMACY PRACTICE-IVA (HOSPITAL PHARMACY) THEORY

Pharm-471 Cr. Hr. 03

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:**

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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.

PHARMACY PRACTICE-VA (CLINICAL PHARMACY) THEORY

Pharm-472 Cr. Hr. 03

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 atleast 25 Important Medications e.g. Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cepahlosporins, Chlorpheniramine, Cimetidine, Digoxin, Dobutamine, Dopamine, Fluroquinolone, 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

b) Adverse Drug Reactions and Side Effects: Classification, Excessive pharmacological response, Idiosyncrasy, Secondary pharmacological effects, Allergic drug reactions, Detection, Management of ADR, reporting of ADR in light of international health monitoring system.

PHARMACY PRACTICE-VA (CLINICAL PHARMACY) PRACTICAL

Pharm-473 Cr. Hr. 01

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.

PHARMACEUTICS-IVA (INDUSTRIAL PHARMACY) THEORY

Pharm-474 Cr. Hr. 03

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 dying.

4. **COMMUNITION (SIZE REDUCTION):** Reasons for size reduction, Factors affecting size reduction, size analysis, Sieving, Energy Mills (Ball Mill, Endrumer, Edge Rumer, Disintegrant, Colloid Mill, Hammer Mill, Cutter Mill and Fluid Energy Mill etc).

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

6. **CLARIFICATION AND FILTRATION:** Theory, Filter Media, Filter aids, Filter selection and Equipment (Leaf filter, Filter press, Melta filters and Rotary filters).

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.

PHARMACEUTICS-IVA (INDUSTRIAL PHARMACY) PRACTICAL

Pharm-475 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Manufacture of Tablets by Wet Granulation Method, by Slugging and by Direct Compression. Coating of Tablets (Sugar Coating, Film coatingand Enteric Coating). Clarification of liquids by various processes. Size Reduction. Homogenization. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables. Capsule filling by semi automatic machines. Manufacture of sustained action drugs. Tablets Tests like Disintegration. Dissolution. Friability. Hardness and Thickness tests. Determination of weight variation in tablets. Density of powder. Particle size analysis. (Note: A minimum of 10 practicals will be conducted).

PHARMACEUTICS-VA (BIOPHARMACEUTICS & PHARMACOKIENETICS) THEORY

Pharm-476 Cr. Hr. 03

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

2. **GASTRO-INTESTINAL ABSORPTION:** Forces which help in transmembrane movements, Anatomical and physiological factors influencing absorption of drugs. Physicochemical properties of drugs affecting absorption. Absorption of different oral dosage forms.

3. **BIOLOGICAL HALF LIFE AND VOLUME OF DISTRIBUTION:** Introduction, types, methods of determination and application**.**

4. **DRUG CLEARANCE:** Introduction, Mechanism, Models, determination and relationship of clearance with half-life.

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

PHARMACEUTICS-VA (BIOPHARMACEUTICS & PHARMACOKIENETICS) PRACTICAL

Pharm-477 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. 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, Determination of relative and absolute bioavailability. 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 human.

PHARMACEUTICS-VIA (PHARMACEUTICAL QUALITY MANAGEMENT) THEORY

Pharm-478 Cr. Hr. 03

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 SUPPOSITORIES:** 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.

6. **STANDARDIZATION OF PHARMACEUTICALS:**An understanding of quality assurence system adopted in pharmaceutical industry. Good Manufacturing Practices and Current Good Manufacturing Practices.

PHARMACEUTICS-VIA (PHARMACEUTICAL QUALITY MANAGEMENT) PRACTICAL

Pharm-479 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. 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 test. Sterility test, Determination of Ash contents, Determination of Moisture contents, Determination of total solids, Determination of viscosity of syrups, gels, etc., Determination of emulsion types (Note: A minimum of 10 practicals will be performed).

FOURTH PROFESSIONAL

EIGHTH SEMESTER

PHARMACY PRACTICE-IVB (HOSPITAL PHARMACY) THEORY

Pharm-481 Cr. Hr. 03

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.**

5. **PURCHASING, DISTRIBUTION AND CONTROL OF HOSPITAL MEDICINES, MEDICAL & SURGICAL SUPPLIES:** Purchasing, Stocking, Stock Control, Inventory Management, Drug Distribution, Relationship between purchasing, Distribution and Clinical Pharmacy Services.

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):**

PHARMACY PRACTICE-VB (CLINICAL PHARMACY) THEORY

Pharm-482 Cr. Hr. 03

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
  - o 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.

3. DRUG INDUCED DISEASES:

4. UTILIZATION OF CLINICAL DRUG LITERATURE: Introduction, Drug literature selection, Drug literature evaluation and Drug literature communication.

5. ON LINE PHARMACEUTICAL CARE SERVICES AND GLOBALIZATION:

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

7. 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 asthamaticus, childhood asthma, Pneumonia, COPD includes emphysema & chronic bronchitis)
- Unit III: Gastroentrology unit (ulcer, liver cirrhosis, portal hypertension, hepatitis, inflammatory bowel disease, diarrhoea)

PHARMACY PRACTICE-VB (CLINICAL PHARMACY) PRACTICAL

Pharm-483 Cr. Hr. 01

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

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PHARMACEUTICS-IVB (INDUSTRIAL PHARMACY) THEORY

Pharm-484 Cr. Hr. 03

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.).

6. **PACKING & PACKAGING:** Influence of Packaging materials, Stability, Packaging Lines, Packaging Area, Packaging Equipment.

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.

PHARMACEUTICS-IVB (INDUSTRIAL PHARMACY) PRACTICAL

Pharm-485 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g.

1. Manufacture of Tablets by Wet Granulation Method, by Slugging and by Direct Compression.
2. Coating of Tablets (Sugar Coating, Film coating and Enteric Coating).
3. Clarification of liquids by various processes
4. Size Reduction. Homogenization.
5. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables.
6. Manufacture of sustained action drugs.
7. Tablets Tests like Disintegration. Dissolution. Friability. Hardness and thickness tests.
8. Determination of weight variation in tablets. Density of powder. Particle size analysis

(Note: A minimum of 10 practicals will be conducted).

PHARMACEUTICS-VB (BIOPHARMACEUTICS & PHARMACOKIENETICS) THEORY

Pharm-486 Cr. Hr. 03

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 diseaseand 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.

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

PHARMACEUTICS-VB (BIOPHARMACEUTICS & PHARMACOKIENETICS) PRACTICAL

Pharm-487 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g.

1. Blood Sampling Techniques (In laboratory animals like dog, rabbits, mice etc. in human beings),
2. In-vitro dissolution studies,
3. Optional dose determination,
4. Measurement of rate of Bioavailability,
5. Determination of relative and absolute bioavailability.
6. Plasma level-time curve (Determination of Pharmacokinetic parameters). Determination of plasma protein binding.
7. Urinary sampling techniques in laboratory animals.
8. Renal excretion of drugs or drug disposition in animals and humans.

PHARMACEUTICS-VIB (PHARMACEUTICAL QUALITY MANAGEMENT) THEORY

Pharm-478 Cr. Hr. 03

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:**Alcoholometric 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.

5. **MISCELLANEOUS DETERMINATIONS AND TESTS:** Determination of weight/ml, Water/Moisture content, Loss on Drying, Evaluation of Ointments, Ash contents and Alkalinity of Glass.

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

PHARMACEUTICS-VIB (PHARMACEUTICAL QUALITY MANAGEMENT) PRACTICAL

Pharm-479 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g.
Determination of alcohol contents in the Pharmaceutical preparations Pyrogen test.
Sterility test,
Determination of Ash contents,
Determination of Moisture contents,
Determination of total solids,
Determination of viscosity of syrups, gels etc.
(Note: A minimum of 10 practicals will be performed).

FIFTH PROFESSIONAL

NINTH SEMESTER

PHARMACEUTICS-VIIA (PHARMACEUTICAL TECHNOLOGY) THEORY

Pharm-591 Cr. Hr. 03

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

PHARMACEUTICS-VIIA (PHARMACEUTICAL TECHNOLOGY) PRACTICAL

Pharm-592 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g.

1. Various techniques to develop the formulation,
2. Granulation technology,
3. Study of drug delivery systems,
4. In-vitro Quality Control of various dosage forms.
5. Particle size analysis using various methods,
6. Stability studies of Pharmaceuticals.
7. Preparation and Coating of particles.

(Note: A minimum of 10 practicals will be performed).

PHARMACY PRACTICE-VIA (ADVANCED CLINICAL PHARMACY) THEORY

Pharm-593 Cr. Hr. 03

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: Infectiuos diseases (Meningitis, tuberclosis, dermatological infections, Rabies, Urinary track infection, Malaria fever, typhoid fever, fungal infections of skin, Dengue Fever, Common Cold, Pharyngitis & Tonsillitis, Conjunctivitis)
- Unit VII: Endocrinlology Unit (Diabeties Mellitus, Hyper/Hypo thyroidism, pitutary gland non-malingnant disorders)

4. DRUG UTILZATION 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, Phenytoin, Cabamazepine, Phenobarbitone, Valproic Acid, Cyclosporins and Vancomycin.

PHARMACY PRACTICE-VIB (ADVANCED CLINICAL PHARMACY) PRACTICAL

Pharm-594 Cr. Hr. 01

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**.**

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PHARMACY PRACTICE-VIIA (FORENSIC PHARMACY) THEORY

Pharm-595 Cr. Hr. 03

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.

3. **PHARMACEUTICAL ETHICS:**Patents and Generics, Ethics in Sale, Ethics in Industry, Ethics in Research.

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.

PHARMACY PRACTICE-VIIIA (PHARMACEUTICAL MANAGEMENT & MARKETING) THEORY

Pharm-596 Cr. Hr. 03

1. **MANAGEMENT & MARKETING:**

a. Nature and Principles of Management
b. Types and Functions of Managers
c. Planning: Purpose and types of Planning, Steps in Planning
d. Organizing
e. Management Control Systems. Purpose: Steps in the Control Process, Forms of Operations control. Requirements for adequate control, Critical control points and standards
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.

PHARMACEUTICAL CHEMISTRY-IVA (MEDICINAL CHEMISTRY) THEORY

Pharm-597 Cr. Hr. 03

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, Fluorouracil, Mercapturine, Methotrexate and Vincristine.
c. Sedatives & Hypnotics: Benzodiazepines, Barbiturates, Paraldehyde, 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.

PHARMACEUTICAL CHEMISTRY-IVA (MEDICINAL CHEMISTRY) PRACTICAL

Pharm-598 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g
ulpha drugs, Aspirin, Paracetamol, Benzyl Penicillin, Inorganic preparations.
1. Estimation of functional groups; Carboxylic, Hydroxy, Amino and Nitro groups; Determination of Molecular weights of Organic Compounds.
2. Synthesis of Paracetamol, Salicylic Acid, Methyl salicylate, Azobenzene, Benzoic Acid, 5-Hydroxy-1, 3-benzoxazol-2-one, Aspirin, P-nitrosophenol, 3-nitrophthalic acid, o-Chloro-benzoic acid.
3. Assay of the Drugs like Sulpha drugs, Aspirin, Paracetamol, Benzyl Penicillin, Inorganic preparations.
(Note: A minimum of 10 practicals will be conducted).

FIFTH PROFESSIONAL

NINTH SEMESTER

PHARMACEUTICS-VIIB (PHARMACEUTICAL TECHNOLOGY) THEORY

Pharm-5101 Cr. Hr. 03

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.
c. Fundamentals of Genetic Engineering and its Application in Medicine.
d. Pharmaceutical Recombinant therapeutic Proteins, Growth factors, Therapeutic antibodies, High-throughput screening of putative therapeutic compounds.
e. Biotechnological aspects in the product development.
f. Principle, Synthesis and Application of Monoclonal Antibodies.
g. Immobilized Enzymes and their application in Medicine.

PHARMACEUTICS-VIIA (PHARMACEUTICAL TECHNOLOGY) PRACTICAL

Pharm-5102 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g.
1. Various techniques to develop the formulation,
2. Granulation technology,
3. Study of drug delivery systems,
4. Biotechnological aspect of product development.
(Note: A minimum of 10 practicals will be performed).

PHARMACY PRACTICE-VIB (ADVANCEDCLINICAL PHARMACY) THEORY

Pharm-5103 Cr. Hr. 03

1. **PHARMACEUTICAL CARE, ITS SCOPE, MANAGEMENT AND APPLICATIONS:**

2. **CLINICAL THERAPEUTICS:**
General Strategy: Terminology of Disease. Management and treatment. Drug selection.

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.

5. **SAFE INTRAVENOUS THERAPY & HAZARDS OF I.V. THERAPY:**

6. **NON-COMPLIANCE:** Definition, introduction and importance, Extent of non-compliance, Methods of assessment, Reasons for non-compliance, Strategies for improving compliance.

PHARMACY PRACTICE-VIB (ADVANCED CLINICAL PHARMACY) PRACTICAL

Pharm-594 Cr. Hr. 01

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.

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PHARMACY PRACTICE-VIIB (FORENSIC PHARMACY) THEORY

Pharm-5105 Cr. Hr. 03

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:

PHARMACY PRACTICE-VIIIB (PHARMACEUTICAL MANAGEMENT & MARKETING) THEORY

Pharm-5106 Cr. Hr. 03

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.

PHARMACEUTICAL CHEMISTRY-IVB (MEDICINAL CHEMISTRY) THEORY

Pharm-5107 Cr. Hr. 03

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

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

a. Sulphonamides: Prontosil, sulphanilamide, Sulphapyridine, sulphadimidine, Sulfamethoxazole, Sulfadiazine and Sulfafurazole.

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

c. Diuretics: Mercaptomerin, Meralluride, Thiazides, Sprironolactone, Theophylline, Furosemide, Acetazolamide, Ethacrynic acid and Triameterene.

d. Antitubercular Drugs: Ethambutol, Isonicotinic acid, Hydrazid, Rifampacin, Thioguanine, Pyrazinamide, cycloserine, Ethunamide, Cytarabine, 5-Flourouracil and Dacarbazine.

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

f. Immunosuppressant Agents: Azathioprine and Cyclosporin.

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

PHARMACY PRACTICE-VIB (CLINICAL PHARMACY) PRACTICAL

Pharm-5108 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. 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-1, 3-benzoxazol-2-one, Aspirin, P-nitrosophenol, 3-nitrophthalic acid, o-Chloro-benzoic acid. Assay of the Drugs like Sulpha drugs, Aspirin, Paracetamol, Benzyl Penicillin. Inorganic Preparations **(**Note: A minimum of 10 practicals will be conducted).

NOTE: Upon completion of recognized Pharm.D. degree, a pharmacy graduate is required to undergo residency based training for a period of 1 year in any area; at general or private Hospital, Pharmaceutical Industry, Community Pharmacy, Pharmaceutical Marketing, Research & Development and Public health recognized by the Pharmacy Council of Pakistan. The objective of the residency is to undergo a planned training on aspects of pharmacy practice under the supervision of a registered pharmacist.