DETAILS OF COURSES (ANNUAL SYSTEM)

FIRST PROFESSIONAL

PHARMACEUTICAL CHEMISTRY-I (ORGANIC) (Theory)

Paper 1 **Marks 100**

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

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

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

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

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

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

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

7. **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.

8. **REACTIVE INTERMEDIATE AND FREE RADICALS:**
   a. Introduction: Generation, stability and reaction of the following Intermediates; Carbocations, Carbanions, Carbenes, Nitrenes, Benzynes,
   b. Types of reactions: An Overview.
   c. Free radicals: Free radical scavengers and their applications.

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

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

PHARMACEUTICAL CHEMISTRY-I (ORGANIC) (Practical)

Paper 7 **Marks 100**

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.

1. Organic analysis: Identification of unknown simple organic compounds.
2. Organic Preparations: Benzoic acid, Aspirin, Acetanilide, Iodoform, Nitrophenol, 3-nitrophthalic acid, Benzhydrol and 2, 4-Dinitrochlorobenzene.

PHARMACEUTICAL CHEMISTRY-II (BIOCHEMISTRY) (Theory)

Paper 2 **Marks 100**

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).

3. **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.

4. **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.

5. **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-II (BIOCHEMISTRY) (Practical)

Paper 8 **Marks 100**

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.

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.

PHARMACEUTICS-I (PHYSICAL PHARMACY) (Theory)

Paper 3 **Marks 100**

1. **PHARMACY ORIENTATION:** Introduction and orientation to the Professional 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: Solubility, 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 and shapes, 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.

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

6. **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, fractional, 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.

7. **EXTRACTION PROCESSES:**
   a. Maceration: Purpose & process.
   b. Percolation: Purpose and Process.
   c. Liquid-Liquid extraction: Purpose and Process.
   d. Large scale extraction: Purpose and Process.

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

9. **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.

PHARMACEUTICS-I (PHYSICAL PHARMACY) (Practical)

Paper 09 **Marks 100**

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.

1. Experiments to demonstrate some of Physico-chemical processes like simple distillation, steam distillation, crystallization, dialysis.
2. Determination of Emulsion systems.
3. Determination of particle size.
4. Density, Specific Volume, Weights and Volumes of Liquids.
5. Preparation of Buffer solutions and isotonic solution.
6. Determination of %age composition of solutions by specific gravity method.
7. Partition-coefficient, surface tension, viscosity.

PHYSIOLOGY (Theory)

Paper 4 **Marks 100**

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, Multi-enzyme 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 Messengers, 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 Neuro-modulators, Neuro-effector 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, type 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.

3. 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, Anatomy, 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 (Practical)

Paper 10 **Marks 100**

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.

4. SENSORY SYTEM: Visual activity, far vision, near vision and Field of vision (Perimetry).

5. NEURAL CONTROL MECHANISM: Nerve Muscle Preparation in frog, Effect of Temperature on muscle and Demonstration of spinal reflexes.

ANATOMY & HISTOLOGY (Theory)

Paper 5 **Marks 50**

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 and types of Connective tissue and Cartilage.
    c. Bones: Structure and types of bones and joints.
    d. Muscles: Structure of skeletal muscle, smooth muscle and 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. Ventricles, Cerebellum Anatomy of Cerebellum, Brain Stem Mid-Brain. 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 (Theory):**

    (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)

Paper 11 **Marks 50**

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.

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.

ENGLISH COMPULSORY (Written)

Paper 6 **Marks 100**

Part: A (Functional English):

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: To be improved by showing documentaries/films carefully selected by subject teachers

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.

Part: B (Communication Skills):

Objectives: Enable the students to meet their real life communication needs.

Course Contents:

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

Essay writing: Introduction, Descriptive, narrative, discursive, argumentative

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 skills: Letter/memo writing, minutes of meetings, use of library and internet.

NOTE: Documentaries to be shown for discussion and review.

Part: C (Technical Writing and Presentation Skills):

Objectives: Enhance language skills and develop critical thinking.

Course Contents:

Presentation skills:

Essay writing: Descriptive, narrative, discursive, argumentative

Academic writing: How to write a proposal for research paper/term paper, (emphasis on style, content, language, form, clarity, consistency).

Technical Report writing:

Progress report writing:

NOTE: Extensive reading is required for vocabulary building.