**Aims & Objectives of the Pharm.D. Program:** The aims and objectives of Doctor of Pharmacy (Pharm.D.) curriculum are to prepare graduates who will have the capacity, uptodate knowledge, strong ethical values, behavior, communication, writing and social skills that will enable them to pursue careers in:

1. Pharmaceutical care in health systems and community environment where appropriate medication usage and patient's safety is paramount.
2. Pharmaceutical industry and its quality systems.
3. Academia, research and development.

**Aims**: To prepare pharmacy graduates whose scientific knowledge and skills enable them to work with the pace to ensure the quality in the design, manufacture, distribution and safe and effective use of pharmaceuticals in the society and clinical setting.

**Objectives:**

1. To keep pace with the advancements in the modern sciences.
2. To prepare the students to fulfill the industrial needs and they should be well versed with the basic medical and pharmaceutical sciences in order to prepare a dosage regimen for an individual patient.
3. Community pharmacy practice should be comprehensive.
4. Internship in various disciplines of Pharmacy should be implemented.
5. Update the syllabi of the Pharmacy keeping in view the current proposals, requirements and the Needs of the profession.
6. To make our graduates more skillful, competitive and knowledgeable both practically and theoretically.
7. To cater the local and international pharmacy needs.
8. Uniformity in the curriculum of Pharmacy at national level.
9. Credit hours should be harmonized i.e. practical and theory credit hours.
10. To make a health care practitioner who is expert in the use of medicine in all practical fields and are capable of disease state management specially to improve public health at large.
11. Upon graduation, the graduates should have the capacity, knowledge and capability to undertake career in;
    a) Enhance patient safety to safe medication usage in community and health care systems
    b) To work in the pharmaceutical industry and its quality system
    c) To engage in academics and research i.e. Practice and Academics.
    d) To prepare students as good human beings in serving the community i.e., ethics, communication skills, writing skills, behavior etc.
    e) After graduation, he should become a member of health care team.
    f) To help the stakeholders of pharmacy about the implications of WTO and TRIPS.
12. The syllabi should be more practical rather theoretical.
13. To include new things regarding OTC Pharmacy (Patient Pharmacist interaction).

14. To prepare pharmacy graduates for better pharmacy practice in the areas including clinical pharmacy, community pharmacy, hospital pharmacy and industrial pharmacy.
15. To add further in the curriculum clinical oriented areas as per demand of Pharm.D degree.
16. To update the current syllabi according to the needs of the national and international demand.
17. To develop graduates capable of catering the needs of national and international health organizations or authorities to help adapt the paradigm shift in the health care system.
18. To bring uniformity in the contents of the syllabi in line with International trends/ international universities imparting Pharm.D education.
19. To produce the graduates to meet the challenges of 21$^{st}$ century of health care problems.

# Faculty of Pharmacy

The faculty will comprise of the following departments with relevant subjects

1. **Department of Pharmaceutics**
   - Pharmaceutics-I (Physical Pharmacy)
   - Pharmaceutics-II (Dosage Forms Science)
   - Pharmaceutics-III (Pharmaceutical Microbiology & Immunology)
   - Pharmaceutics-IV (Industrial Pharmacy)
   - Pharmaceutics-V (Biopharmaceutics)
   - Pharmaceutics-VI (Pharmaceutical Quality Management)
   - Pharmaceutics-VII (Pharmaceutical Technology)

2. **Department of Pharmaceutical Chemistry**
   - Pharmaceutical Chemistry-I (Organic Chemistry)
   - Pharmaceutical Chemistry-II (Biochemistry)
   - Pharmaceutical Chemistry-III (Pharmaceutical Analysis)
   - Pharmaceutical Chemistry-IV (Medicinal Chemistry)

3. **Department of Pharmacognosy**
   - Pharmacognosy-I (Basic)
   - Pharmacognosy-II (Advanced)

4. **Department of Basic Medical Sciences**
   - Physiology
   - Anatomy & Histology
   - Pathology
   - Pharmacology & Therapeutics -I (Basic)
   - Pharmacology & Therapeutics -II (Advanced)

5. **Department of Pharmacy Practice**
   - Pharmacy Practice-I (Pharmaceutical Mathematics and Biostatistics)
   - Pharmacy Practice-II (Dispensing, Community, Social & Administrative Pharmacy)
   - Pharmacy Practice-III (Computer and its Applications in Pharmacy)
   - Pharmacy Practice-IV (Hospital Pharmacy)
   - Pharmacy Practice-V (Clinical Pharmacy-I)
   - Pharmacy Practice-VI (Clinical Pharmacy-II)
   - Pharmacy Practice-VII (Forensic Pharmacy)
   - Pharmacy Practice-VIII (Pharmaceutical Management and Marketing)

# Scheme of Courses for Pharm.D. (Five-Year Course):

## 1st Professional Pharm.D.

| 1st Semester | | | 2nd Semester | | |
|---|---|---|---|---|---|
| **Course No.** | **Subject** | **Cr. Hr.** | **Course No.** | **Subject** | **Cr. Hr.** |
| ENG 300 | English-A (Functional English) | 2 | ENG 301 | English-B (Communication & Writing skills) | 4 |
| PHARM 310 | Pharmaceutics-IA (Physical Pharmacy) | 3+1 | | | |
| PHARM 311 | Pharmaceutical Chemistry-IA (Organic) | 3+1 | PHARM 315 | Pharmaceutics-IB(Physical Pharmacy) | 3+1 |
| PHARM 312 | Pharmaceutical Chemistry-IIA (Biochemistry) | 3+1 | PHARM 316 | Pharmaceutical Chemistry-IB (Organic) | 3+1 |
| PHARM 313 | Physiology-A | 3+1 | PHARM 317 | Pharmaceutical Chemistry-IIB (Biochemistry) | 3+1 |
| PHARM 314 | Anatomy & Histology | 3+1 | | | |
| | | | PHARM 318 | Physiology-B | 3+1 |
| | **Total Cr. Hr. 22** | | | **Total Cr. Hr. 20** | |

## 2nd Professional Pharm.D.

| 1st Semester | | | 2nd Semester | | |
|---|---|---|---|---|---|
| **Course No.** | **Subject** | **Cr. Hr.** | **Course No.** | **Subject** | **Cr. Hr.** |
| IS 402 | Islamic Studies | 3 | PS 403 | Pakistan Studies | 2 |
| PHARM 410 | Pharmaceutics-IIA (Dosage Forms Science) | 3+1 | PHARM 415 | Pharmaceutics-IIB (Dosage Forms Science) | 3+1 |
| PHARM 411 | Pharmaceutics-IIIA (Pharmaceutical Microbiology & Immunology) | 3+1 | PHARM 416 | Pharmaceutics-IIIB (Pharmaceutical Microbiology & Immunology) | 3+1 |
| PHARM 412 | Pharmacology and Therapeutics-IA | 3+1 | PHARM 417 | Pharmacology and Therapeutics-IB | 3+1 |
| PHARM 413 | Pharmacognosy-IA (Basic) | 3+1 | PHARM 418 | Pharmacognosy-IB (Basic) | 3+1 |
| PHARM 414 | Pharmacy Practice-IA (Pharmaceutical Mathematics) | 3 | PHARM 419 | Pharmacy Practice-IB (Bio-statistics) | 3 |
| | **Total Cr. Hr. 22** | | | **Total Cr. Hr. 21** | |

## 3rd Professional Pharm.D.

| 1st Semester | | | 2nd Semester | | |
|---|---|---|---|---|---|
| **Course No.** | **Subject** | **Cr. Hr.** | **Course No.** | **Subject** | **Cr. Hr.** |
| PHARM 510 | Pharmacy Practice-IIA (Dispensing Pharmacy) | 3+1 | PHARM 515 | Pharmacy Practice-IIB (Community, Social & Administrative Pharmacy) | 3 |
| PHARM 511 | Pharmaceutical Chemistry-IIIA (Pharmaceutical Analysis) | 3+1 | PHARM 516 | Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis) | 3+1 |
| PHARM 512 | Pharmacology and Therapeutics-IIA | 3+1 | PHARM 517 | Pharmacology and Therapeutics-IIB | 3+1 |
| PHARM 513 | Pharmacognosy-IIA (Advanced) | 3+1 | PHARM 518 | Pharmacognosy-IIB (Advanced) | 3+1 |
| PHARM 514 | Pathology | 3+1 | PHARM 519 | Pharmacy Practice-III (Computer and its Applications in Pharmacy) | 3+1 |
| | **Total Cr. Hr. 20** | | | **Total Cr. Hr. 19** | |

## 4th Professional Pharm.D.

| 1st Semester | | | 2nd Semester | | |
|---|---|---|---|---|---|
| **Course No.** | **Subject** | **Cr. Hr.** | **Course No.** | **Subject** | **Cr. Hr.** |
| PHARM 610 | Pharmacy Practice-IVA (Hospital Pharmacy) | 3 | PHARM 615 | Pharmacy Practice-IVB (Hospital Pharmacy) | 3 |
| PHARM 611 | Pharmacy Practice-VA (Clinical Pharmacy-I) | 3+1 | PHARM 616 | Pharmacy Practice-VB (Clinical Pharmacy-I) | 3+1 |
| PHARM 612 | Pharmaceutics-IVA (Industrial Pharmacy) | 3+1 | PHARM 617 | Pharmaceutics-IVB (Industrial Pharmacy) | 3+1 |
| PHARM 613 | Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics) | 3+1 | PHARM 618 | Pharmaceutics-VB(Biopharmaceutics & Pharmacokinetics) | 3+1 |
| PHARM 614 | Pharmaceutics-VIA (Pharmaceutical Quality Management) | 3+1 | PHARM 619 | Pharmaceutics-VIB (Pharmaceutical Quality Management) | 3+1 |
| | **Total Cr. Hr. 19** | | | **Total Cr. Hr. 19** | |

## 5th (Final) Professional Pharm. D.

| 1st Semester | | | 2nd Semester | | |
|---|---|---|---|---|---|
| **Course No.** | **Subject** | **Cr. Hr.** | **Course No.** | **Subject** | **Cr. Hr.** |
| PHARM 710 | Pharmaceutics-VIIA (Pharmaceutical Technology) | 3+1 | PHARM 715 | Pharmaceutics- VIIB (Pharmaceutical Technology) | 3+1 |
| PHARM 711 | Pharmacy Practice-VIA (Advanced Clinical Pharmacy-II) | 3+1 | PHARM 716 | Pharmacy Practice-VIB (Advanced Clinical Pharmacy-II) | 3+1 |
| PHARM 712 | Pharmacy Practice-VIIA (Forensic Pharmacy) | 3 | PHARM 717 | Pharmacy Practice-VIIB (Forensic Pharmacy) | 3 |
| PHARM 713 | Pharmacy Practice-VIIIA (Pharmaceutical Management & Marketing) | 3 | PHARM 718 | Pharmacy Practice-VIIIB (Pharmaceutical Management & Marketing | 3 |
| PHARM 714 | Pharmaceutical Chemistry-IVA (Medicinal Chemistry) | 3+1 | PHARM 719 | Pharmaceutical Chemistry-IVB (Medicinal Chemistry) | 3+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** |

# DETAILS OF COURSES (SEMESTER SYSTEM)

## FIRST PROFESSIONAL

### FIRST SEMESTER

**ENGLISH-A (FUNCTIONAL ENGLISH)**

**ENG 300** **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 310** **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 310** **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 311** **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 center, Geometrical isomerism, Resolution of racemic mixture, Conformational analysis.
3. **GENERAL METHODS OF PREPARATION, PROPERTIES, IDENTIFICATION TEST AND PHARMACEUTICAL APPLICATIONS OF THE FOLLOWING CLASSES AND THEIR ANALOGUES:**
    i. Alkane, Alkenes, Alkynes, Aromatic compounds
    ii. Alkyl halide, Alcohol, phenols, ethers, amines
    iii. Ketones, Aldehydes
    iv. Acids, Esters, Amides and derivative

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 311** **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 312** **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 312** **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 313** **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 313** **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 314** **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 314** **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.

## SECOND SEMESTER

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

**ENG 301** **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 315** **Cr. Hr. 03**

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