PharmD Curriculum

The curriculum of PharmD is designed to develop critical thinking and problem-solving skills, and an empathy and appreciation for the patient in a graduated manner as the student progresses through the program. Students are given a foundation upon which to develop skills, moving progressively to become independent learners and practitioners. Our goal is to prepare the students for a changing practice with the proper knowledge, attitudes and behaviors.

The Doctor of Pharmacy (PharmD) is 6 years degree program. The total credit offered is 217. PharmD is designed to provide students with a wide variety of clinical experiences in different settings and the opportunity to care for various types of patients and their illnesses. During the sixth professional year, each student will get the opportunity to be experienced in specified areas (adult internal medicine, ambulatory care, hospital/health system, pharmacy and community practice) and four rotations selected from the elective rotations list, such as drug information, special populations (pediatrics, geriatrics, psychiatry), hospital, surgery, critical care, nutrition, rural health, women's health, academic, research (toxicology, drug delivery systems, drug development, social and behavioral sciences), regulatory, professional society, industry, others. Each rotation is a six-week intensive, hands-on encounter. The desired outcome of these practical encounters is to provide students with the tools necessary to apply the knowledge received from didactic instruction and early practice experiences to the “real-life” patient care settings under the tutelage of a knowledgeable practitioner.

COURSE DISTRIBUTION

1st professional Year

1st Semester (10 Credits)

Course Code	Titles	Credits
PHRD 6101	Introduction to Pharmacy	2
PHRD 6102	Communications & Computer Application in Pharmaceutical Sciences	2
PHRD 6103	Pharmaceutical Statistics	3
PHRD 6104	Inorganic Pharmacy	3

2nd Semester (10 Credits)

PHRD 6105	Human Physiology I	3
PHRD 6106	Pharmaceutical Microbiology I	3
PHRD 6107	Organic Pharmacy	3
PHRD 6104L	Inorganic Pharmacy Lab	1

3rd Semester (12 Credits)

PHRD 6108	Human Physiology II	3
PHRD 6109	Pharmaceutical Microbiology II	3
PHRD 6110	Anatomy & Histology	3
PHRD 6106L	Pharmaceutical Microbiology Lab	1
PHRD 6107L	Organic Pharmacy Lab	1
PHRD 6100	Viva	1

2nd Professional Year

1st Semester (11 Credits)

Course Code	Titles	Credits
PHRD6201	Human Physiology III	3
PHRD6202	Biochemistry I	3
PHRD6203	Pharmacognosy	3
PHRD6105L	Human Physiology lab I	1
PHRD6110L	Anatomy & Histology Lab	1

2nd Semester (11 Credits)

PHRD6204	Biochemistry-II	3
PHRD6205	Pharmaceutical Dosage Form -I	3
PHRD6206	Physical Pharmacy	3
PHRD6203L	Pharmacognosy lab	1
PHRD6108L	Human Physiology Lab II	1

3rd Semester (13 Credits)

PHRD6207	Pharmaceutical Dosage Form -II	3
PHRD6208	Pharmacology I	3
PHRD6209	Pharmaceutical Analysis-I	3
PHRD6206L	Physical Pharmacy Lab	1
PHRD6205L	Pharmaceutical Dosage Form Lab I	1
PHRD6202L	Biochemistry Lab	1
PHRD6000	Viva voce	1

3rd Professional Year

1st Semester (14 Credits)

Course Code	Titles	Credits
PHRD6301	Pharmaceutical Dosage form -III	3
PHRD6302	Pharmacology-II	3
PHRD6303	Pharmaceutical Analysis-II	3
PHRD 6304	Pathology I	3
PHRD 6207	Pharmaceutical Dosage form Lab-II	1
PHRD 6209L	Pharmaceutical Analysis lab	1

2nd Semester (13 Credits)

PHRD 6305	Pharmacology III	3
PHRD 6306	Pathology II	3
PHRD 6307	Medicinal Chemistry-I	3
PHRD 6308	Biopharmaceutics & Pharmacokinetic Principles	3
PHRD 6207L	Pharmaceutical Dosage form –II Lab	1

3rd Semester (12 Credits)

PHRD 6306	Pharmacology-IV	3
PHRD 6307	Medicinal Chemistry-II	3
PHRD 6308	Clinical Pharmacokinetics	3
PHRD 6208L	Pharmacology Lab I	1
PHRD 6304L	Pathology Lab	1
PHRD 6300	Viva voce	1

4th Professional Year

1st Semester (12 Credits)

Course Code	Titles	Credits
PHRD 6401	Toxicology	3
PHRD 6402	Pharmaceutical Calculation	3
PHRD 6403	Community Pharmacy	3
PHRD 6302L	Pharmacology Lab-II	1
PHRD 6308L	Clinical Pharmacokinetics Lab	1
PHRD 6307L	Medicinal Chemistry Lab	1

2nd Semester (12 Credits)

PHRD 6404	Pharmaceutical Care-I	3
PHRD 6405	Clinical Pharmacy & Pharmacotherapy-I	3
PHRD 6406	Drug Delivery System	3
PHRD 6407	Pharmaceutical Dispensing	3

3rd Semester (12 Credits)

PHRD 6408	Pharmaceutical Care II	3
PHRD 6409	Clinical Pharmacy & Pharmacotherapy-II	3
PHRD 6410	Patient Assessment & Counseling	2
PHRD 6411	Drug Literature & Information	2
PHRD 6407L	Pharmaceutical Dispensing Lab	1
PHRD 6400	Viva voce	1

5th Professional Year

1st Semester (13 Credits)

Course Code	Titles	Credits
PHRD 6501	Pharmaceutical Care III	3
PHRD 6502	Principles of Diagnosis & Monitoring	3
PHRD 6503	Patient Safety	2
PHRD 6504	Forensic Medicine	2
PHRD 6505	Pharmacogenomics	3

2nd Semester (14 Credits)

PHRD 6506	Pharmaceutical Care IV	3
PHRD 6507	Pharmacy Law & Ethics	2
PHRD 6508	Non-Prescription Drugs & Self Care	3
PHRD 6509	Hospital Pharmacy	3
PHRD 6510	Pharmacoepidemiology	3

3rd Semester (13 Credits)

PHRD 6511	Pharmaceutical Care V	3
PHRD 6512	Practice Management & Marketing	3
PHRD 6513	Pharmacoeconomics	3
PHRD 6514	Pharmaceutical Policy and Public Health	3
PHRD 6500	Viva voce	1

6th Professional Year

Courses	Titles	Credits
REQUIRED Advanced Pharmacy Practice Experiences		**24**
PHRD 6601	APPE: Hospital Pharmacy	6
PHRD 6602	APPE: Internal Medicine (Adult, Pediatrics, Geriatrics)	6
PHRD 6603	APPE: Ambulatory Care APPE:	6
PHRD 6604	Community Practice	6
ELECTIVE Advanced Pharmacy Practice Experiences (any four)		3x4 = 12
PHRD 6605	APPE: Research	
PHRD 6606	APPE: In plant Training	
PHRD 6607	APPE: Administration	
PHRD 6608	APPE: Critical Care	
PHRD 6609	APPE: Drug Information	
PHRD 6610	APPE: Extended Care	
PHRD 6611	APPE: Rehabilitation	
PHRD 6612	APPE: Nuclear Pharmacy	
PHRD 6613	APPE: Rural Health	

Courses	Title and description	Credits
PHRD 6101	**Introduction to Pharmacy:** Introducing pharmacy profession to the students: Differences between occupation and profession. Definition and characteristics of pharmacy profession. Social recognition and status of pharmacy profession. Scopes and opportunities for pharmacists. Pharmacy career development – International and Bangladesh perspective.Pharmacy education and its specialty: Brief introduction of the courses taught in a pharmacy program.Definition of drugs and medicines: Sources of drugs. Classification of drugs on the basis of actions, target organs and uses. Chemical, generic and brand names.History and evaluation of Pharmacy: Ancient ages, Middle ages, Modern ages. Development of pharmacy in Bangladesh.Dosage forms, Routes of drug administrations, Active ingredients, excipientsDifferent systems of medicine: Allopathic, Ayurvedic, Unaani and Homeopathic systems of medicine.Pharmacists' code of ethics'; Professional organizations; Laws and regulatory affairs.Sources of Information, Some common terms and abbreviations used in pharmaceutical sciences.	**2**
PHRD 6102	**Communications & Computer Application in Pharmaceutical Sciences:** Provides a general understanding of computer applications and functions of the components of a computer system. Topics include components of computer systems; concepts of software; introduction to operating systems; history of computer languages; programming fundamentals; basics such as constant, variables, data type, operators and expressions, pointer; concepts of database; internet technology and World Wide Web. This course undertaken in a lab setting also provides functional orientation to word processing, spreadsheet, presentation, database and WebPages design. Students also learn some basic skills in searching and evaluating online resources. Advance use of statistical tools (SPSS, Sigma plot).	**2**
PHRD 6103	**Pharmaceutical Statistics:** Statistics and its application. Variables and Attributes. Classification and tabulation of data. Populations and samples. Frequency distributions. Graphical presentation of data. Describing and summarizing data: statistical averages & measures of dispersion. probability andprobability distributions. Hypothesis testing: concepts, types, p-value. Test of significance: parametric tests (t-test, One way ANOVA, multiple comparison tests (Bonferoni, Duncan, Dunnet, Tukey), repeated measure ANOVA; Non-parametric tests: Mann-whiteney, Wilcoxon rank test, Kruskal-Wallis test, multiple comparison tests (Tukey), Friedman's test. Regression (simple linear & nonparametric regression) and correlation (simple & rank correlation), Chi-square & odds ratio.	**3**
PHRD 6104	**Inorganic Pharmacy:** An introduction to the inorganic chemicals used in the pharmaceuticals and studying their basic laws and behaviors. Structure of the atom and molecules. The chemistry of co-ordination compounds. Study of medicinal inorganic compounds, such as, Antioxidants; Gastrointestinal agents; Dental preparations; Topical agents, etc.	**3**
PHRD 6105	**Human Physiology-I:** Cell: Structure and functions. Cell organelles, Cell Division, Transport across cell membrane and membrane potential Tissue: Definition and classification. Epithelial tissue. Connective tissue. Muscle tissue. Blood, bone and cartilage. Nerve tissue. Characteristics, Classification and functions of various tissues and their minute	**3**

structure. Blood: Composition and function. Plasma: Electrolytes, Proteins and other organic constituents. Blood cells: Their formation and destruction, cell count, functions of different blood cells.Hemoglobin: Structure, properties and function. Anemia: Causes and classification. Blood coagulation: Blood groups. Blood transfusion. Lymph: Composition, formation, circulation and function, lymph nodes. Circulatory system Heart: Structure, heart muscles, conducting system of heart, The Action Potential in Cardiac Muscle origin and transmission of cardiac impulse; ECG. Control and requirements for the normal heart beat. Cardiac cycle, cardiac output, Venous return.Blood vessels: Types of blood vessels and their functions. Blood pressure: Measurements and regulation of blood pressure. Nervous control and chemical control. Systemic and Pulmonary circulation: Importance and functions. Alimentary system Structure of the different parts of the alimentary system. Movements of the different parts of the alimentary tract and their control, swallowing, gastric contractions. Intestinal contraction, defection secretion of digestive juices, Saliva, gastric juice, pancreatic juice, intestinal juice and bile. Mechanism and control of the various secretions and their functions. Digestion of food stuff. Absorption of the different digested materials.

PHRD 6106 Pharmaceutical Microbiology I: **3**

It deals with the basic knowledge of different groups of microorganisms and also a detailed study of morphology, nutrition, growth, cultivation and preservation of bacteria. Microscopy: Bright field, dark field, fluorescence, phase contrast, electron microscopy. Properties of selected bacterial species. Study of yeast, molds and viruses. Principle of microbial pathogenesis and epidemiology. Microbiological spoilage and preservation of pharmaceutical products. Contamination of non sterile pharmaceuticals and preservation of pharmaceutical products. Chemical disinfectants, antiseptics and preservatives. Contamination of non-sterile pharmaceuticals in hospital and community environment

PHRD 6107 Organic Pharmacy: **3**

The objective of the course is to introduce the physical and chemical behavior of organic molecules.Aliphatic hydrocarbons: Alkanes / cycloalkanes, alkenes and alkynes: The variation of physical properties of alkanes, alkenes and alkynes mainly boiling / melting point and solubility. Methods of preparation, principle of different reactions and some applications in pharmacy. Alkyl halides/ halogenoalkanes, alcohols: The variation of physical properties like boiling point, melting point and solubility of halogenoalkanes and alcohols plus the effect of different factors on the variation of boiling/melting point or solubility. The different methods of preparation (laboratory method, fermentation etc.) and reactions of halogenoalkanes and alcohols which are important from pharmaceutical viewpoint. Special attention will be imposed on Pharmaceutical applications of halogenoalkanes and alcohols.Ethers and Carbonyl compounds (aldehyde, ketone, carboxylic acid and its derivatives especially amines): The physical properties of ether and carbonyl compounds like aldehyde, ketone, carboxylic acid and its derivative (mainly amines). The methods of preparation of ethers and carbonyl compounds and their reactions. Carboxylic acid and at least one derivative which is important from pharmaceutical viewpoint. Principle of different types of reactions and the utilities of the reactions in the laboratory synthesis of drug molecules: Principles of different types of reactions like addition, substitution

(electrophilic, nucleophilic and free radical substitutions), Elimination, rearrangement reactions etc and their application in the synthesis of small drug molecules in the laboratory.A brief review of organic chemistry, type of organic compounds, aromatic compounds: benzene and its derivatives, sources, preparation, nomenclature of aromatic compounds, structure of benzene, stability of benzene, aromaticity, properties, preparations of benzene and its derivatives like phenols, nitrobenzenes, benzoic acids, anilines, aromatic aldehydes and ketones, benzene sulphonic acids etc., directive effect, activation and deactivation of benzene rings. Synthesis of some drugs like paracetamol, salicylic acid, benzoic acid, aspirin, sulphanilamide etc.Organic reactions and mechanisms: Principles, mechanisms and importance of electrophilic and nucleophilic reactions, 1, 2 and 1, 4 additions, electrophilic / nucleophilic (SN1, SN2) substitutions, E1, E2 reactions, free radical additions and substitutions, rearrangement reactions etc.Important Name Reactions and there Pharmaceutical importance.

PHRD 6104L **Inorganic Pharmacy lab:** **1**

Qualitative analysis of Inorganic compounds., Manufacturing of Inorganic Drugs, such as aluminium hydroxide, ferrous ferrous sulfate.

PHRD 6108 **Human Physiology-II:** **3**

Introduction to Human Physiology

The Endocrine System:

Hormones: Definition, secretion, importance, mechanism of action, transportation and storage. Structure, functions and secretions and regulations of Pituitary gland, Thyroid gland, Adrenal gland, Pancreatic islets and other common hormones. The Nervous System: Introduction to nervous system, structure and functions of neuron, brain components and their functions. Neuronal communications, Synapses, Neurotransmitters and their receptors Reflex, types of reflexes, circuitry, pathophysiology Nerve sensations, modalities, receptors Nociception, dual pain pathways, descending modulation, opiate system, targets for analgesia Autonomic nervous system, control of visceral organs, types, biosynthesis and biodegradation of neurotransmitters, receptor types and subtypes, pathophysiology, pharmacology of autonomic nervous system.

Recommended Books:

Textbook of Medical Physiology – Guyton

Review of Medical Physiology- W.F. Ganong

PHRD 6109 **Pharmaceutical Microbiology II:** **3**

Detailed structure of prokaryotic and eukaryotic cell. Translational activation of amino acids, initiation, elongation and termination of protein synthesis in prokaryotes. Inhibitors of protein synthesis. Post translational modification of proteins. Genetic code - definition, deciphering and silent features of genetic code, composition of pro and eukaryotic ribosome, structure of t-RNA , coding and non coding strands of DNA role of signal peptides. Prokaryotic gene regulation-Operon, Lac operon , positive and negative control. Gene mutation types, point mutation, insertion and deletion.

Recommended Books:

1. Molecular Biology of the Cell - Alberts, et al
2. Lehninger Principles of Biochemistry (David L, Nelson, Michael M. Cox)

PHRD 6110 **Anatomy & Histology:** **3**

History of anatomy and the different disciplines of the subject

Explain anatomical nomenclature General Anatomy Skeletal System: Axial skeleton, Different bones of human body, Axial and appendicular skeleton, Functions of bone.

Joints: Structural , regional and functional classification of joints, Characteristics, classification and movements of synovial joints, Anatomy of joints with reference to dislocation and injury (clinical). Muscle: Parts and classification of a muscle, Classification of muscle, Blood supply and nerve supply of muscle, Anatomy of the neuromuscular junction, Anatomy of muscle with reference to sprain, spasm and injury. General Histology: Cell as a whole, Different components of a cell and description of its functions, Anatomy of cell membrane, Types of epithelium and their anatomical location, Histological appearance of cartilage, Histological appearance of bone, Cartilage and bone, Histological features of muscle. Histological features of central venous system, Histological features of peripheral nerve and spinal cord, Histology of lymphoid tissue General Embryology:

Recommended Books:

1. Gray's Anatomy by Prof. Susan Standring 39th Ed., Elsevier.
2. Clinical Anatomy for Medical Students by Richard S.Snell.
3. Clinically Oriented Anatomy by Keith Moore.

PHRD 6106L **Pharmaceutical Microbiology Lab:** **1**

Study of compound microscope. Microscopic observation of stained cell preparations. Preparation of culture media (Nutrient broth and Nutrient Agar), Pure culture isolation and identification. Gram-staining technique for identification of gram positive and gram negative bacteria. Inoculation techniques, Serial dilution for colony counting, Bacterial Growth curve, Antibiotic sensitivity test by disk-diffusion method. Minimum Inhibitory Concentration Determination

PHRD 6107L **Organic Pharmacy Lab:** **1**

Qualitative Analysis of organic salts.

Qualitative Analysis of organic salts.Preparation and purification of 2-iodobenzoic acid from anthranilic acid Preparation and purification of acetanilide. Separation of benzoic acid, phenol and aniline from their mixture by acid-base extraction

PHRD 6201 **Human Physiology-III:** **3**

This course will deal with Respiratory System and Male and Female reproductive systems along with the related hormones, pregnancy and lactation. Respiratory System: Structure of respiratory system, Anatomy of lungs, ventilation, lung capacities, Gaseous exchange in the alveoli, transport of gases, nervous and chemical regulation of respiration, respiratory disorders. Male Reproductive System: Anatomy of male reproductive organ, spermatogenesis, testosterone and other male sex hormones, functions of testosterone, abnormalities of male sexual function. Female Reproductive System: Anatomy of female reproductive organ, Female hormonal system, Monthly ovarian cycle, Functions of estrogen and progesterone, Endometrial cycle and

menstruation, Menopause and female fertility.

Recommended Books:

Textbook of Medical Physiology – Guyton and Hall

Review of Medical Physiology- W.F. Ganong

PHRD 6202 **Biochemistry-I:** **3**

The primary focus of this course is to make students familiar with key biochemical molecules and their role in cellular activities in the body. Introduction: Biochemistry and the organization of cells: Relevance to pharmacy studies. Chemical components of cells / Biomolecules. Proteins : Structures and Functions, The Behavior of Proteins: Enzymes, Mechanism & Kinetics. Carbohydrates. Lipids Metabolism : Basic Concepts & Design. Catabolism --Generation of energy. Glycolysis, TCA cycle, Oxidative phosphorylation. Anabolism – Synthesis of biomolecules

Recommended Books:

1. Biochemistry by J.M. Berg. J.L. Tymo and L Stryer.
2. Lehninger Principles of Biochemistry (David L, Nelson, Michael M. Cox)
3. Molecular Biology of the Cell – Alberts

PHRD 6203 **Pharmacognosy:** **3**

This is an introduction to the origin of medicines and pharmaceuticals, searching of a novel molecule as a tool for discovery of new drugs or molecular modification of existing drugs from plants, implication of plants and animals' secondary metabolites as pharmaceuticals and medicines and their purification techniques. Introduction: Definition of pharmacognosy, its subject matter, importance of pharmacognosy in pharmacy, historical development of pharmacognosy and some terminology. Crude Drugs: Definition, classification with examples, merits and demerits of each classification. Adulteration Of Crude Drugs: Definition of adulteration, inferior drugs, deteriorated drugs, spoiled drugs and admixed drugs with examples. Undeliberate adulteration and its causes. Deliberate adulteration and its different conditions (admixture, deterioration, sophistication and substitution) with proper examples of each. Evaluation Of Crude Drugs: A short description of organoleptic, microscopical, chemical, biological and physical evaluation with parameters. Carbohydrates: Classification, definitions (mono & polysaccharide, aldose, ketose, triose, tetrose, glucosan, fructosan etc.) .Biological source, chemical constituents and uses of some important carbohydrate drugs. Glycosides: Definition and composition, physical properties, classifications with examples and pharmacological importance. Biological source, chemical constituents and uses of some important glycoside drugs. Tannins: Definition, classification with brief description and examples, pharmacological and pharmaceutical importance of tannins. Fats, Oils And Waxes: Definition and composition of fixed oils, fats and waxes, classification, physical properties and importance. Biological source, chemical constituents and uses of some important fixed oils, fats and waxes Volatile Oils: Definition and composition, extraction methods, physical properties, difference from fixed oils, chemical constituents and importance of volatile oils. Biological source, chemical constituents and uses of some important volatile oils. Resins: Definition, composition, classification, physical properties, chemical constituents of resins. Biological source, chemical constituents and uses of some important resin drugs. Proteins: Definition, composition, classification, physical

properties, chemical constituents of proteins. Biological source, chemical constituents and uses of some important proteins. Alkaloids: Definition, composition, classification of alkaloids. Biological source, chemical constituents and uses of some important alkaloids. Phytochemistry Of Plant Drugs: Definition and a brief idea about the chemistry and uses of plant constituents Medicinal Plants Of Bangladesh: Definition, contribution of medicinal plants to modern medicine, Monographs of some medicinal plants of Bangladesh. Traditional Medicine: Definition and scope, different systems, methods of diagnosis and treatment, scientific basis, merits and demerits. Fibres And Surgical Dressings: Definition of fibres, surgical dressings, gauzes, bandages, lints with their various types and uses. Analysis Of Plant Constituents: Different extraction methods and separation techniques for plant constituents with their principles, techniques and applications.

Recommended Books:

1. Pharmacognosy. Varro E. Tyler, Lynn R. Brady & James E. Robbers.
2. Pharmacognosy. Trease and Evans
3. Text book of Pharmacognosy. T.E. Wallis
4. Practical Pharmacognosy. R. Zafar
5. Text book of Pharmacognosy, Abdul Ghani
6. Text book of Pharmacognosy, Mohammed Ali

PHRD 6105L **Human Physiology Lab-I:** **1**

Determination of blood pressure Determination of bleeding time, clotting time; Determination of Blood group, Hemoglobin count.

PHRD 6110L **Anatomy & Histology Lab:** **1**

1. Identification of muscle tissues under microscope
2. Identification of lymphoid tissue under microscope
3. Identification of muscle tissues under microscope
4. Identification of connective tissue, cartilage and bone under microscope
5. Identification of skin under microscope

PHRD 6204 **Biochemistry-II:** **3**

Nucleic acids, Structure of DNA, Central Dogma of biological systems, transcription and translation, protein synthesis, protein folding, Gel electrophoresis, restriction mapping. Vitamins, their types and roles in biological systems.

Recommended Books:

1. Biochemistry by J.M. Berg. J.L. Tymo and L Stryer.
2. Lehninger Principles of Biochemistry (David L, Nelson, Michael M. Cox)
3. Molecular Biology of the Cell - Alberts, et al

PHRD 6205 **Pharmaceutical Dosage form –I:** **3**

Solutions:

Definition of solutions, The process of dissolution, Solvent effect on dissolution, Methods of expressing the concentration of solutions, Solubility, Methods of expressing solubility, Factors affecting the solubility of solids in liquids, Solvents for pharmaceutical use (with brief description and application of each), Pharmaceutical

ingredients used in preparation for oral solution (with purposes and examples), Preparation of solutions, Different extraction methods used for preparing solutions, Dry mixture for solution, Oral rehydration solution, sterile solutions. Syrup and its classification, Components of syrups, Purposes of preparing sugar and non-sugar based syrup, Different methods of preparation of syrups, Elixirs and its preference over aqueous syrup, Properties, classification and preparation procedure of elixirs, Tinctures with their properties, Definitions and uses of aromatic waters, spirits, liniments and collodions. Stability testing of solutions and its purpose, different stability studies.
Suspensions: Definition and purposes of preparation, different forms of suspension, desired features, Sedimentation rates of particles and Stokes' Law with its importance and limitations, effects of viscosity on rate of sedimentation of particles, physical properties of dispersed particles(particle-vehicle interactions, particle- particle interactions, rheological properties), sedimentation parameters(sedimentation volume, degree of flocculation), different flocculating agents, method of preparation of suspensions with example, packaging and storage of suspensions, sustained- release suspensions, extemporaneous compounding of suspensions, physical stability of suspensions, flocculated and non-flocculated suspensions, controlled flocculation.
Emulsions:

Recommended books:

1. Industrial Pharmacy, Lachman. 3rd Ed.
2. Modern Pharmaceutics: Banker, 4th Edition.
3. Pharmaceutics: The dosage form design: Aulton.
4. Bentley' Text book of Pharmaceutics, edited by E.A. Rawlins. 8th Edition.
5.Cooper and Gunn's Tutorial Pharmacy, edited by S.J.Carter
6. Sprowl's American Pharmacy, Lewis W. Dittert. Ph.D
7.Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V.Allen,Jr; Nicholas G.Popovich, Howard C. Ansel

PHRD 6206 **Physical Pharmacy:** **3**

This course is designed to enable the students to understand the basics of the physical and chemical nature of molecules, which will be helpful in designing proper formulation and manufacturing of dosage forms Rheology: Newtonian and non-newtonian systems, plastic and pseudo plastic flow, dilatant flow, thixotrophy. Solutions: Types and properties of solutions, units of concentration, ideal and real solutions, Henry's law, Effect of temperature on solubility, Nernst's distribution law, partition coefficient, solvent extraction. Ionic equilibria: Ionic theories of acids bases and salts, Lowry-Bronsted theory of acids and bases, dissociation of water, dissociation constants of acids and bases, hydrolysis of salts, pH equation derivation of salt solutions, Buffer solution, biological and pharmaceutical buffers, Henderson equation, Indicators for acid-base titration. Chemical Kinetics and stability: Definitions, rates and orders of reactions, molecularity of reactions, kinetic expression of different order of reactions, chemical degradation (Hydrolysis, oxidation, polymerization etc.), stability testing, accelerated stability studies, prediction of shelf-life. Chemical thermodynamics: Introduction, scope and limitations, types of thermodynamic systems and processes, First law of thermodynamics, enthalpy, heat capacities, thermochemistry, thermochemical laws, 2nd law of thermodynamics,

entropy.
Colloidal dispersions: Interaction and stability of colloids, pharmaceutical applications of colloids. Types of colloidal dispersions, preparations, properties and purification of colloids: Diffusion and Dissolution: Fick's law of diffusion, steady state diffusion, diffusion study, diffusion principles in biological systems. Dissolution: Drug release, drug release from modern drug delivery systems. Phase Equilibria: Phase rule, eutectic mixture, azeotropic mixture, polymorphism. Surface and interfacial phenomena: Surface and interfacial tension, adsorption at liquid surfaces, classification of surfactants, HLB system, critical micelle concentration, application of surface active agents Electrochemistry: electrolysis, electrolytic cell, electrolytic conductance, ionization of drugs, electrochemical cell, electrodes, nernst equation. Micromeritics: Introduction and concepts of particle size determination, different means of expressing particle size, methods of particle size determination, powder properties. Pre-formulation studies: physical and chemical incompatibilities.

PHRD 6203L **Pharmacognosy lab:** **1**

Study of some medicinal plant of Bangladesh. General test for carbohydrates e.g. glucose, fructose, lactose, sucrose, maltose etc. Examinations of starch and related products. Extraction and identification of some anthraquinone derivatives from senna cascarda, sagrada, aloe. Extraction & Identification of Caffeine from tea, coffee. Separation of different substances by thin-layer chromatography (TLC). Study of cardiac glycosides and some cardio-active drugs: Digitalis, squill, strophanthus. Examination of some saponin containing drugs: sarsaparilla, discorea. Study of alkaloids and some alkaloid containing drugs: Belladonna, stramonium, hyoscyamus, cinchona, rauwolfia nux-vomica, ergot, ephedra, colchicum.

PHRD 6108L **Human Physiology lab-II:** **1**

Identification of blood cells under microscope, WBC count (TC and DC), Determination of ESR, Ecocardiogram.

PHRD 6207 **Pharmaceutical Dosage form –II:** **3**

Definition, composition and purpose of emulsification, types, orally administered emulsions and emulsions for external application, preparation method of emulsions, emulsifying agents and their types, desirable properties and selection of emulsifying agents, the HLB system, mixed emulsifying agents and their importance, emulsion stability, different forms of instability of emulsions. Topical Preparations: Definition and purposes, percutaneous absorption of topical preparations, factors affecting percutaneous absorption. Ointments: Definition, ointment bases, physicochemical properties of ointment bases, classification of ointment bases depending on composition and penetrability, selection of appropriate base, ophthalmic ointments, preparation of ointments, microbial content and preservation, packaging, storage and labeling. Creams: Definition, composition, types and application of creams. Gels: Definition, properties, classification and types, preparation of magmas and gels, gelling agents, gel formulation considerations, some important magmas and gels. Suppositories:Introduction, advantages and disadvantages, absorption, ingredients used in formulation, essential properties and types, tablet excipients and their uses, Implants and Pellets : Introduction, advantages and disadvantages, absorption, ingredients used in formulation, essential properties and types, tablet excipients and their uses

Recommended books:

1. Theory and Practice of Industrial Pharmacy - Leon Lachman
2. Modern Pharmaceutics - Banker, 4th Edition.
3. Pharmaceutics: The dosage form design - Aulton.
4. Remington's Pharmaceutical Sciences

PHRD 6208 **Pharmacology I:** **3**

Introduction to pharmacology, history, scope, limitation and pharmacological terminology. Routes of drug administration and its fate. Autacoids: Histamine, Bradykinines and their antagonists. Lipid derived autacoids, analgesics, antipyretic and anti-inflammatory agents. Drug used in the treatment of asthma. The vitamins: water soluble and fat soluble vitamins.

Recommended Books:

1. The Pharmacological Basis of Therapeutics (10th Edition). Goodman & Gilman.
2. Medical Pharmacology (5th Edition). HP Rang, MM Dale, JM Ritter
3. Basic and Clinical Pharmacology (8th Edition). Bertram G Katzung

PHRD 6209 **Pharmaceutical Analysis-I:** **3**

Introduce with different chemical and physical techniques used for the identification and estimation or standardization of drugs by using different chemical methods of analysis in the pharmaceutical industry. The art and science of pharmaceutical analysis; Introduction; Precipitation methods: Titration involving precipitation, Mohr, adsorption and volhard method, Complexometric titrations: Introduction, complexes and chelates, stability of chelates and complexes, titration based on complex formation, types of complexiometric titration, application in pharmacy Non-aqueous titrations: Theory, titration of weak bases, titration of weak acids, scope Aquametry: Principle and scope, physical method for water determination, Potentiometric titrations: Introduction, theory and principles, electrochemical cells and half cells, electrodes, measurement of potential, application of potentiometric titration. Introduce with various physical techniques used for the identification, characterization, molecular weight determination and estimation or standardization of drugs or pharmaceuticals in pharmaceutical industry. Chromatographic methods of analysis; Spectroscopy: Visible, UV, IR. Introduction to Chromatography: A brief description of the evolution and principle of Chromatography, stationary and mobile phases used in Chromatography, different kinds of Chromatography (like liquid chromatography or gas chromatography) based on the phases used, uses of Chromatography. Thin Layer Chromatography (TLC): TLC plate, Micro-pipettes/ capillaries, spotting the plate with sample, the development of the tank, developing the plate, visualizing the developed plate, retention factor(Rf) some useful staining systems for the visualization of the spots not seen under UV lamp, comparisons with authentic materials and resolving close running materials, Two-dimensional chromatography and its development using TLC technique, uses of two-dimensional chromatogram of a mixture of stable and unstable components, Identification of some strangely shaped spots on TLC plates and their prediction. Utility of TLC in pharmaceutical analysis. Column Chromatography (CC): Gravity column chromatography (GCC) and Flash chromatography (FCC) and

their differences. A separate brief description about the equipment, choosing the solvent system, packing the column, loading the sample, eluting the column, disposal of the adsorbent for both gravity column and flash column chromatography. Utility of column chromatography in pharmaceutical analysis, Introduction to Vacuum liquid chromatography (VLC).

PHRD 6206L **Physical Pharmacy Lab:** **1**

Preparation of solutions of different pH. Preparation of buffer. Standardization of acids & bases. Determination of adsorption isotherm of oxalic (or acetic) acid from aqueous solution by charcoal and calculation of the constant in Freundlich's equation. Determination of energy of flow of a liquid through a capillary by measuring viscosity as a function of temperature. Determination of the equilibrium constant of the reaction KI +I2 = KI3 at a known temperature. Determination of the velocity constant of the hydrolysis of ethyl acetate in the basic medium. Determination of viscosity of pure liquids such as glycerin, alcohol and nitrobenzene using Ostwald viscometer. Study of variation of viscosity of a liquid with temperature using Ostwald or Engler's viscometer. Determination of solubility of a sparingly soluble salt in water by conductance measurement. Determination of velocity constant for the hydrolysis of an ester in the basic medium by conductance measurements.

PHRD 6205L **Pharmaceutical Dosage form Lab-I** **1**

Physical checking of emulsions suspensions, syrups, ointments, suppositories' etc. Formulation of emulsions, suspensions, syrups, ointments, suppositories etc. Preparations, problems encountered during preparation, physical evaluation of the different dosage forms: i) Tablets including coated tablets, ii) Capsules, iii) Suppositories, iv) Pharmaceutical Aerosols.

PHRD 6202L **Biochemistry Lab:** **1**

Qualitative and Quantitative determination of fat, protein and carbohydrates in biological samples: determination of albumin in egg, glucose tolerance test, determination of creatinine.

PHRD 6301 Pharmaceutical Dosage form –III: Suppositories:Introduction, advantages and disadvantages, absorption, ingredients used in formulation, essential properties and types, tablet excipients and their uses, Implants and Pellets : Introduction, advantages and disadvantages, absorption, ingredients used in formulation, essential properties and types, tablet excipients and their uses Inhalation dosage form : Introduction, advantages and disadvantages, absorption, ingredients used in formulation, essential properties and types, tablet excipients and their uses **3**

Recommended books:

1. Theory and Practice of Industrial Pharmacy - Leon Lachman
2. Modern Pharmaceutics - Banker, 4th Edition.
3. Pharmaceutics: The dosage form design - Aulton.
4. Remington's Pharmaceutical Sciences

PHRD6302 **Pharmacology-II:** **3**

Drugs used in infectious disease. Antimicrobial, antifungal and anti viral agents. Sulfonamides, Quinolone derivatives; Penicillins and cephalosporins, amino-glycosides, miscellaneous antibacterial agents. Topical and systemic antifungal agents. Anti viral agents, such as, anti-herpes, anti-influenza and others. Chemotherapy of

neoplastic disease: Different anti-neoplastic agents. Drugs used in immunomodulation: Immunomodulators, immuno-suppressive agents, tolerogens, immuno-stimulants.

Recommended Books:

1. The Pharmacological Basis of Therapeutics (10th Edition). Goodman & Gilman.
2. Medical Pharmacology (5th Edition). HP Rang, MM Dale, JM Ritter
3. Basic and Clinical Pharmacology (8th Edition). Bertram G Katzung

PHRD 6303 Pharmaceutical Analysis-II: 3

Introduce with various physical techniques used for the identification, characterization, molecular weight determination and estimation or standardization of drugs or pharmaceuticals in pharmaceutical industry. Ultraviolet (UV) – Visible Spectroscopy:Electromagnetic radiation(EMR) and its properties, emission and absorption spectra, units for expressing EMR, electromagnetic spectrum, the absorption laws with mathematical expression and limitations, types of electronic transition with examples, selection rules of electronic transition, transition probability and types of transition depending on the value of Emax, symmetry restrictions in electronic transition, principle of electronic spectroscopy, different parts and function of UV-visible spectrophotometer, formation of absorption bands, types of absorption bands, effect of solvent and temperature on fineness of absorption bands, chromophore and its types, identification of chromophores, Auxochrome, absorption and intensity shifts, solvents used in UV spectroscopy, effect of polarity of solvent on the position and intensity of the absorption for a particular chromophore and also on absorption bands, Woodward-Fieser rules for calculating absorption maxima of dienes and alpha-beta unsaturated carbonyl compounds, steric hindrance and coplanarity, colorimetric analysis with its purpose, procedure and advantages, applications of UV spectroscopy.
Infra-Red (IR) Spectroscopy: Principle of IR spectroscopy, kinds of vibrations-stretching and bending, Hooke's law for calculating vibrational frequency for a functional group, regions of interest in IR spectroscopy, factors affecting vibrations frequency of carbonyl functional groups, sampling techniques for taking IR spectra, wave numbers range of some important functional groups required for structural elucidation of unknown compounds, application of IR spectroscopy in pharmaceutical analysis. Fluorometry/ Fluorescence Spectroscopy: Absorption of radiation by molecules and origin of absorption spectra, difference between fluorescence and phosphorescence, excitation spectra and emission spectra, molecular structure and fluorescence, measurement of fluorescence intensity/ instrumentation, quantitative fluorescence analysis, Application of fluorometry in pharmaceutical analysis.

Recommended Books:

1.Elementary Organic Spectroscopy, Y.R.Sharma; S.Chand
2.Pharmaceutical Drug Analysis, Ashutosh Kar
3.Introduction to Spectroscopy, Pavia, Lampman, Kriz, Vyvyan
4.A Textbook of Pharmaceutical Analysis, Kenneth A. Connors

PHRD 6304 Pathology I: 3

This course is designed to give pharmacy students an idea of different patho-physiologic conditions of disease occurrence, progression and the causes of disease manifestations. The course will also survey the principles of toxicology that pertain to

the human health and the environment. Introduction to Pathology Diseases: Manifestation and patho-physiology Cellular adaptations to stress Cellular injury and death : Causes and Mechanisms (Apoptosis and Necrosis) Cellular aging Acute and chronic inflammation Tissue repair: Regeneration, Healing and Fibrosis

PHRD 6207 **Pharmaceutical Dosage form –II Lab:** **1**

Physical checking of emulsions suspensions, syrups, ointments, suppositories' etc. Formulation of emulsions, suspensions, syrups, ointments, suppositories etc. Preparations, problems encountered during preparation, physical evaluation of the different dosage forms: i) Tablets including coated tablets, ii) Capsules, iii) suppositories, iv) Pharmaceutical Aerosols

PHRD 6209L **Pharmaceutical Analysis lab:** **1**

Assay of acetyl salicylic acid in aspirin tablets, non-aqueous assay of phenobarbitone tablets, assay of antazoline hydrochloride in antihistamine tablets, non-aqueous titration of PAS tablets, determination of potency of penicillin tablets, determination of potency of vitamin tablets, determination of calcium gluconate tablets and injections by EDTA titration, determination of saponification value, iodine value and acid value of fixed oils, assay of sulfa-drugs by nitrate titration, microbiological assay of vitamins and antibiotics. Assay, identification and potency determination of a variety of pharmaceutical products:

PHRD 6305 **Pharmacology - III** **3**

Drugs affecting gastro intestinal functions:

Overview of regulation of gastric acid secereton. Mechanism of action, therapeutic uses, pharmacokinetics, adverse effects of antacids, H2 receptor antagonists, proton pump inhibitors, mucosal protective agents. Therapeutic management of gastrointestinal disorder. Mechanism of action, therapeutic uses, pharmacokinetics, adverse effects of antidiarrheals and laxatives. Mechanism of action, therapeutic uses, pharmacokinetics, adverse effects of antiemetic drugs. Therapeutic management of emesis. Antihyperlipidemic drugs : Overview of lipid metabolism. Mechanism of action, therapeutic uses, pharmacokinetics, adverse effects of HMG-CoA reductase inhibitors, Fibrates, Bile acid sequestrants, Niacin. Therapeutic management of lipid disorders. Immunusuppresants : Overview of immune system. Mechanism of action, therapeutic uses, pharmacokinetics, adverse effects of selective inhibitors of cytokine production and function, antimetabolites, Antibodies, Adrenocorticoids and Niacin. Therapeutic management of immune disorders.

Recommended Books:

1. The Pharmacological Basis of Therapeutics (10th Edition). Goodman & Gilman.
2. Medical Pharmacology (5th Edition). HP Rang, MM Dale, JM Ritter
3. Basic and Clinical Pharmacology (8th Edition). Bertram G Katzung
4. Principle of Toxicology. Craset & Dohl.
5. clinical pharmacy and therapeutics – edited by Roger Walker, Clive Edwards
6. Disease management – Randall and Neil.

PHRD 6306 **Pathology II:** **3**

Haematology : Introduction to haematology and hemopoiesis, Haemorrhagic disorders, Leukocytic disorders Blood groups, Blood Transfusion Systemic Pathology: Atherosclerosis, Hypertension, Ischaemic heart disease, Congenital heart disease,

Endocardial and pericardial diseases, Cardiomyopathies, Pneumonias, Chronic Bronchitis and Emphysema, Gastritis and Peptic Ulcer, Tumours of upper GIT, Viral Hepatitis, Cirrhosis, Diabetes mellitus, Acute nephritis and rapidly progressive GN, Nephrotic syndrome, Renal failure:- Clinical Pathology: Differential diagnosis of Jaundice, Renal function tests, Diabetes mellitus

PHRD 6307 Medicinal Chemistry-I: 3

Introduction to Medicinal Chemistry and Drug Discovery: A brief review of medicinal chemistry, searching of new lead compounds, types of drug discovery, structure activity relationship (SAR), bioisosterism, 'me too' compounds, physicochemical properties in relation to biological action, drug distribution, metabolism and excretion, receptor, acid-base properties, partition-coefficient, steric features of drugs, optical isomerism etc. Basic concepts on biological/mechanism of action of drugs: The role of physicochemical properties of drug molecules like acidity, basicity, solubility etc. that affect the hydrophilicity or lipophilicity and the action of drug. Stereochemical features in relation to drugs activity, basics of drug-receptor interaction, receptor agonist, antagonist etc. Chemistry, SAR, molecular modification and synthesis of the following group of drugs: Antihypertensive agents – beta blockers, ACE inhibitors, angiotensin receptor blockers Histamine and Antihistamine Agents and Antiulcerants: Histamine - Introduction, biosynthesis and distribution, storage and release, histamine receptors Histamine H1 antagonists – Mechanism of action, structure activity relationship, first and second generation H1 antagonist drug classes, mast cell stabilizers, dual-acting antihistamines, chemical syntheses. Histamine H2 antagonists – Mechanism of acid secretion, peptic ulcer and other related diseases, evolution and structural derivation, structure activity relationship, chemical syntheses. Proton Pump Inhibitors (PPIs) – Parietal cells and proton pump, mechanism of inhibition, SAR of PPIs, evolution of omeprazole and esomeprazole, H. pylori and ulcer, chemical syntheses. Analgesic, Antipyretic and Anti-inflammatory Agents: Narcotic analgesics – Pain and nociception, modulation of pain transmission, opioid receptors, tolerance and dependence, morphine and related compounds, SAR of opioid analgesics, modification of morphine by simplification of the core structure, narcotic antagonists and their SAR, opioids to treat diarrhea. Non-steroidal anti-inflammatory drugs (NSAIDs) – Effects, prostaglandins and thromboxane, classification of NSAIDs, mechanism of action, COX 1 and COX 2 enzyme inhibitors, SAR, chemical syntheses. Diuretics: Introduction and classification of diuretics, SAR, mechanism of action of carbonic anhydrase inhibitors, thiazides, loop diuretics, potassium sparing diuretics and osmotic diuretics, therapeutic uses, diuretic resistance, chemical syntheses.

Recommended Books:

1. An Introduction to Medicinal Chemistry – Graham L. Patrick
2. A Textbook of Organic Medicinal and Pharmaceutical Chemistry- Wilson and Gisvold
3. Essentials of Medicinal Chemistry - Andrejus Korolkovas
4. Burger's Medicinal Chemistry and Drug Discovery
5. 5. Foye's Principles of Medicinal Chemistry

PHRD 6308 Biopharmaceutics & Pharmacokinetic Principles: 3

This course includes the techniques used to assess the availability of the pharmaceutical product inside the body so as to ensure its proper therapeutic efficacy. Introduction to boipharmaceutics & pharmacokinetics: Definition of boipharmaceutics,

pharmacokinetics, pharmacodynamics. Subjects area of biopharmaceutics etc. Gastrointestinal absorption of drugs: Biological consideration-Cell membrane physiology, Mechanism of passage of drugs across cell membrane, Effect of surface area, pH gastric empting time, intestinal motility, food etc. on drug absorption etc.
Physiological consideration: pH, partition theory, dissolution, drug stability& degradation in the GI tract etc. Dosage form consideration: Influence of excipients, type & manufacturing process of dosage form etc. Disintegration and dissolution: Noyes-whitney eqation, Factor affecting dissolution rate, In vitro-in vivo correlation of dissolution. Distribution of drug: Some important pharmacokinetics parameters-elimination rate constant, biological half- life, apparent volume of distribution, interpretation of drug plasma level-time curve. Drug protein interaction. Method for studying drug protein binding etc. Drug clearance: Theoretical aspects of drug elimination. Renal excretion-effects of urine pH. Determination of renal clearance. Hepatic drug elimination-biotransformation of drugs, pharmacokinetics of drugs and metabolites, enzyme induction & enzyme inhibition. First pass effects.
Bioavailability and bioequivalence: Definition of various parameters relater to bioavailability. Purpose of bioavailability studies. Methods of assessing bioavailability etc.

Recommended Books:

1. Biopharmaceutics & Clinical Pharmacokinetics. M. Gibaldi.
2. Biopharmaceutics & Clinical Pharmacokinetics. Notari.
3. Pharmacokinetics. M. Gibaldi & D. Perrier.
1. 4. Basic Pharmacokinetics : Sunil S Jambhekar and Philip J Breen

PHRD 6207L **Pharmaceutical Dosage form –II Lab:** **1**

Physical checking of emulsions suspensions, syrups, ointments, suppositories' etc. Formulation of emulsions, suspensions, syrups, ointments, suppositories etc. Preparations, problems encountered during preparation, physical evaluation of the different dosage forms: i) Tablets including coated tablets, ii) Capsules, iii) suppositories, iv) Pharmaceutical Aerosols

PHRD 6306 **Pharmacology-IV:** **3**

Drugs affecting on central nervous system: Neurotransmission and central nervous system, sedative and hypnotics, drugs for depression and anxiety, anti-psychotic drugs, drugs for epilepsy, opioid analgesics, general and local anesthetics. Hormone and Hormone antagonist: Putitory hormones, thyroid and antithyroid drugs, Insulin and other oral hypoglycemic agents, estrogens and progestins, androgens, agents affecting calcification. Ocular pharmacology. Dermatological pharmacology.

PHRD 6307 **Medicinal chemistry-II:** **3**

Chemistry, SAR, molecular modification and synthesis of the following group of drugs: Psychotropic drugs and antidepressants – sedatives, hypnotics and tranquilizers
Oral contraceptives and steroidal hormones Anti-aging Drugs: Introduction, vitamins and related compounds, lipid and water soluble vitamins, antioxidants and their mechanism of action, biosynthesis. Concept of drug design, drug discovery and drug development: Basics of drug design and its objectives, lead compound and its sources with example, formation of analogues and prodrugs achieved through drug design; stages of drug discovery and drug development, a brief discussion of the stages with special emphasis on finding a lead compound: screening of natural products and

synthetic 'banks (compound libraries)', serendipity and prepared mind, starting from the natural ligand or modulator, combinatorial synthesis; chemical synthesis of lead compounds like sulfa drugs, methods of lead optimization, toxicity testing, clinical trials. Processes used for drug design and discovery: Molecular modifications: Objectives/advantages of molecular modification, various processes of molecular modification (drug-design based on structure-activity relationship studies) with emphasis on conjunction, disjunction (molecular fragmentation, dissociation), introduction of double bonds, introduction of chiral centres, introduction, removal or replacement of bulky groups, isosteric and bioisosteric substitution. Molecular modifications of antineoplastic drugs, -lactams, cephalosporin's, anti-tubercular drugs and anti-thyroid drugs. Drug design based on pharmacokinetic considerations: Drug distribution and 'survival', pharmacokinetic issues in drug design like chemical stability, metabolic stability, hydrophilic-lipophilic balance, ionization, size etc.; drug design to improve solubility and membrane permeability, making drugs more resistant to hydrolysis and metabolism, making drugs less resistant to drug metabolism; role of drug design for targeting drugs; drug design to reduce toxicity; prodrugs.
Modern tools of drug discovery: Drug design based on QSAR study (computer-assisted drug design) and its limitation. Combinatorial Chemistry: Introduction to combinatorial synthesis and drug discovery through combinatorial synthesis, basic processes of combinatorial chemistry: Parallel Synthesis, Split and Mix Synthesis; Library synthesis on resin beads- solid phase chemistry, template-based libraries, Scaffold and its uses in combinatorial chemistry, Ugi reaction.

Recommended Books:

2. An Introduction to Medicinal Chemistry – Graham L. Patrick
3. A Textbook of Organic Medicinal and Pharmaceutical Chemistry- Wilson and Gisvold
4. Essentials of Medicinal Chemistry - Andrejus Korolkovas
5. Burger's Medicinal Chemistry and Drug Discovery
6. Foye's Principles of Medicinal Chemistry

PHRD 6308	Clinical Pharmacokinetics: This course includes the techniques used to assess the availability of the pharmaceutical product by compartmental analysis such as single or one compartment model; multiple compartment model; pharmacokinetic of drug absorption; multiple dosage regimen etc.	**3**
PHRD 6208L	Pharmacology Lab-I: Maintenance and handling of experimental animals, routes for drug administration. Effect of CNS stimulants and depressants on rats. Effect of drugs on gastrointestinal (GI) motility and GI absorption of rats.	**1**
PHRD 6304L	Pathology Lab: These labs are designed to familiarize students with the common structures of cells and tissues focused on specific organs and organ systems pathology, and are designed to introduce students to specialized and important areas of hospital pathology.	**1**

PHRD 6401 Toxicology: This course is designed to give pharmacy students an idea of different patho-physiologic conditions of disease occurrence, progression and the causes of disease manifestations. The course will also survey the principles of toxicology that pertain to the human health and the environment. Introduction to Pathology Diseases: Manifestation and patho-physiology Cellular adaptations to stress Cellular injury and death : Causes and Mechanisms (Apoptosis and Necrosis) Cellular aging Acute and chronic inflammation Tissue repair: Regeneration, Healing and Fibrosis Principles of toxicology: Different areas of toxicology and toxic agents, Distribution, Excretion and Absorption of toxicants Dose Response Relationships : Assumptions and calculations-Median Lethal Dose, Therapeutic index, Spectrum of undesired effects, Toxicity test in animals, Incidence of acute poisoning and its management. Heavy metal toxicology and antagonists Non-heavy metal environmental toxicants **3**

Recommended Books:

Robins Basic Pathology - Kumar, Abbas, Fausto, Mitchell

Toxicology- Casarette and Doull

PHRD 6402 **Pharmaceutical Calculations:** **3**

This course is designed to equip students with different calculations and functions involved in the dispensing and production of pharmaceuticals. Fundamentals of measurements and calculations. Interpretation of prescription or medication order. The metric system; calculation of dose; reducing and enlarging of formula; density, specific gravity, specific volume; percentage and ratio strength; dilution and concentration; isotonic solutions, electrolyte solutions, rate of flow calculation, other calculations.

Recommended Books:

1. Pharmaceutical Calculations. Howard C. Ansel, Mitchell J. Stoklosa
2. Text book of Pharmaceutical Analysis. K. A. Connors.
3. Pharmaceutical Drug Analysis. Ashutosh.
1. Elementary Organic Spectroscopy. Y. R. Sharma.

PHRD 6403 **Community pharmacy:** **3**

Processing prescriptions , Prescription problems, Counseling/communication skills , Drug information , Documentation, Prescription problems, Compounding, Cytotoxic/hazardous products, Dispensing/delivery of prescription products or devices to patients, Controlled Substances, Over-the-counter products, Therapy monitoring devices, Pharmacy/Personnel Management

PHRD 6302L **Pharmacology Lab-II:** **1**

In vitro test for the evaluation of drugs acting on the cardiovascular system. Evaluation of anti-inflammatory drugs in caraginine-induced oedema of rats. Analysis and interpretation of experimental data

PHRD 6308L **Clinical Pharmacokinetics Lab:** **1**

In vivo study of bio-availability of drug: Determination of concentration of aspirin in urine after oral administration. Determination of paracetamol in blood after oral administration. In vitro study of bio-availability of drug: Disintegration and dissolution tests of solid dosage forms. Determination of viscosity of a prepared emulsion.

PHRD 6307L **Medicinal Chemistry Lab:** **1**

Synthesis of organic compounds of medicinal importance. Preparation and purification

of Acetanilide Synthesis of Aspirin (acetyl salicylic acid) Preparation and purification of Acetaminophen (Paracetamol) Preparation and crystallization of Dibenzylideneacetone by condensation of benzaldehyde with acetone: Claisen-Schimdt reaction Preparation of Methyl salicylate from salicylic acid Preparation and crystallization of p-nitroacetanilide

PHRD 6404 **Pharmaceutical Care-I:** **3**

The course introduces the student to the professional practice of pharmaceutical care. The student will learn what knowledge and experience is necessary to provide pharmaceutical care to patients. The course will explain the criteria for a health care professional practice, and what constitutes a profession. The roles of the patient, the practitioner, and selected components of society are described in the context of pharmaceutical care practice.

PHRD 6405 **Clinical Pharmacy & Pharmacotherapy-I:** **3**

This course is designed to introduce to some of the main drug classes available for the treatment of particular diseases. Students will also learn about basic pharmacology, how to review medication lists and other forms of health documentation, recognize brand and generic drug names and explore their common uses and therapeutic classes. A basic understanding of treatment options available for common disease states will also be developed during this course.

PHRD 6406 **Drug delivery System:** **3**

General overview of important topics and mechanisms in controlled drug delivery systems will be discussed. Fundamental principles in physical chemistry and engineering will be applied toward solving controlled drug delivery problems with accompanying graded problem sets. Approaches to examining experimental problems will be also be covered.

PHRD 6407 **Pharmaceutical Dispensing:** **3**

The prescription: Handling of prescription, source of errors in prescription, care required in dispensing procedures including labeling at dispensed products. Dispensing techniques: Compounding and dispensing procedures, packaging, storage and stability of medicines, labeling of dispensed products. Pharmaceutical calculations: Posology: Calculations of doses for infants, adults and elderly patients, enlarging and reducing recipes, percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solutions, displacement values, etc. Principles involved and procedures adopted in dispensing of: Mixtures,
solutions, emulsions, powders and granules, oral unit dosage forms, inhalations.

PHRD 6408 **Pharmaceutical Care-II:** **3**

Introduction to Problem-Solving Process, Antibiotic Overview, Gout , Otitis Media Community Acquired Pneumonia Meningitis, Osteomyelitis, Endocarditis, Diabetic - Foot Infection, Intra-abdominal Infections,Influenza HIV Overview,Asthma/COPD Pathophysiology Herpes/ Sexually Transmitted Infections, Migraine Headaches, Oral Esophageal, Candidiasis, Drugs and Breast Feeding, Glaucoma ,Tuberculosis.

PHRD 6409 **Clinical Pharmacy & Pharmacotherapy-II:** **2**

Through a series of case studies students will acquire and/or reinforce their skills at understanding diseases and developing and defending optimal treatment plans for successfully managing those diseases. The case studies utilized will integrate relevant

pathophysiological, pharmacokinetic, pharmacoeconomic and pharmacological concepts with appropriate patient specific parameters. Students will be expected to communicate and defend their decisions, including the process followed in making those decisions, in understandable, appropriate written and verbal formats. Variable mixture of discussion, lecture, independent study and laboratory.

PHRD 6410 **Patient Assessment and Counseling:** **3**

Conduct a chart review to determine medication related problems in a patient-specific therapeutic plan. Administer a patient/caregiver interview to obtain information related to therapeutic plans Perform appropriate patient assessment techniques for evaluation of a therapeutic plan Identify appropriate treatment options given a specific patient scenario.Evaluate and utilize the most appropriate evidence based therapeutic goals and guidelines applied to specific patient characteristics to create a patient-specific pharmacotherapeutic plan. Design and implement a care plan to resolve health issues and/or drug-related problems. Document and maintain an intervention database for patient care activities. Prospectively review medication orders and patient health records to evaluate a drug regimen's efficacy, appropriateness, potential toxicity, and cost-effectiveness. Evaluate the effects of medication and patient characteristics on the efficacy and safety of a drug regimen. Perform medication- and patient-specific calculation. Identify, collect and evaluate pertinent data relative to the patient or medication Create a drug-therapy problem list Identify, assess, and avoid medication misadventures, (eg, compatibility/incompatibility, adverse drug reactions, contraindications) Store medications to meet specification/requirements and/or applicable laws Identify social, cultural and socioeconomic factors relevant to communication Counsel a patient, utilizing appropriate communication format, medical terminology and identified social, cultural and socioeconomic factors. Provide recommendation to a healthcare professional or stakeholder utilizing appropriate communication format, medical terminology and identified social, cultural and socioeconomic factors TO9: Demonstrate professional attitudes and behaviors in all activities through performance of duties according to institutional policy, applicable laws, and ethical and social guidelines. Demonstrate respect, collegiality, humility, empathy, cultural awareness, and confidence during interaction with patients, colleagues, and other healthcare providers and appropriately respond to feedback

PHRD 6411 **Drug literature & Information:** **2**

This course develops students' literature evaluation and drug information skills. Students will learn how to conduct a computerized search of the medical literature, critically evaluate articles from the biomedical literature, evaluate sources of drug information, answer drug information questions, and prepare patient education materials. Students will demonstrate their written and verbal communication skills by completing the projects assigned in the course. Students will demonstrate their quantitative reasoning skills by interpreting the statistical information in the biomedical literature

PHRD 6407L **Pharmaceutical Dispensing Lab:** **1**

Compounding and Dispensing aspects of solutions (for oral use, external use, for body cavities),suspensions,emulsions and creams,ointments, pastes, gels,suppositories, pessaries,powders, granules, lozenges, pastilles, pills, tablets, capsule, tablet,triturate, etc.IncompatibilitiesPrepackaging, Dispensing of properties

PHRD 6501 **Pharmaceutical Care –III:** **3**

Through discussion in small groups and within the large class, students will acquire and reinforce their skills in assessing and resolving patients' drug therapy problems in Anemia, Cardiology, Dyslipidemia, Hypertension, Acute Coronary Syndrome, Deep Vein Thrombosis/Pulmonary Embolism, Atrial Fibrillation, Post-Myocardial Infarction Management, Oral, Contraceptives, Menopause

PHRD 6502 **Principles of Diagnosis & Monitoring:** **3**

Preparing for the Patient Encounter; The Medical History, Cardiopulmonary Symptoms; Vital Signs, Clinical Laboratory Studies; Interpreting of Arterial Blood Gases, Clinical Application of the Chest Radiograph; Interpretation of EKG, Therapeutic drug monitoring: Definition, process, monitoring drug therapy, serum drug concentration, common drugs in TDM, factors affecting TDM, Overview of Osteoporosis, Basic Science of Bone Densitometry and Device Operating Principles, X-Ray Science, Radiation Safety and Quality Assurance, Quality Control, Role of the Technologist, Anatomy in Bone Densitometry, Results and Interpretation, Clinical Management of the Osteoporotic Patient, Patient Care in the Bone Densitometry Lab, Patient Positioning and Scan Acquistion, Scan Analysis, Computers in Bone Densitometry, Evaluating DXA Scan

PHRD 6503 **Patients safety:** **2**

Provides an introduction to the science of safety, and how it relates to problems with patient safety in health care. Explains the role of both individuals and systems in improving patient safety. Reviews institutional responses to adverse events, including the topics of risk management and medical malpractice. Emphasizes the importance of communication and teamwork. Students learn the basics of conducting an incident investigation, gain an understanding of the advantages and limitations of error reporting, learn how to disclose errors and adverse events, and learn models for improving safety in hospitals and other health care organizations from both the micro and macro points of view. The course covers , Science of safety, Errors and adverse events in health care, Models of safety and change , Culture of safety, Detection and reporting of injuries and errors Investigative methods , Disclosure of adverse events , Improvements of clinical systems ,Policy interventions.

PHRD 6504 **Forensic Medicine:** **2**

Bangladesh's Legal System: The powers and jurisdiction of courts, procedures for inquest. Application of relevant Legal Sections of the Penal Code.Procedure of court attendance and recording of evidence. Forensic Sciences: Role of Forensic Sciences in crime detection. Law in relation to medical men, Personal Identity, Thanatology Scientific concepts regarding death, Traumatology Mechanical Injuries, Mechanical injuries medicolegal considerations: Laws in relation to causing bodily harm, wounding and homicide, Violent deaths due to asphyxia, Autopsy, Types, objectives, rules, and techniques and describe Procedure for postmortem. Forensic Sexology. Sexual offences and relevant sections of law, Natural and unnatural sexual offences. Miscarriage, Crime against new born, infants and child, Forensic Psychiatry, Examination of biological specimens.

PHRD 6505 **Pharmacogenomics:** **3**

Pharmacogenetics and Pharmacogenomics: Introduction, definition, SNPs and other

polymormphisms. RFLP and direct sequencing as method of studying polymorphisms. Pharmacogenitics of cytochrome p450. e.g. CYP2D6, CYP2C9, CYP2C19, CYP3A4, CYP2A6. Role of NAT2 and CYP2E1 in tuberculosis. Role of different polymorphisms in Lung diseases. Method of studying prominent SNPs using any software. Pharmacogenetics of cancer, psychiatric diseas e, receptor etc. Bioinformatics: Definition and concepts, importance of bioinformatics, biological database, primary sequence database, protein sequence databse, DNA sequence databse, genome resource web addresses. Multiple sequence alignment. Coiled coil protain analysis, Importance of multiple sequence alignment for drug design. Importance of coiled coil peptide for drug design. Cancer Biology and Therapy : Introduction to biology of cancer; Modes of treatment, Radiotherapy. Chemotherapy, Biological therapy including immunology and gene therapy. Other chemotherapeutic targets including vascular targets, Abnormal tumorphysiology, Growth factors, p53 and apoptosis and DNA repair; Relapses and resistance′ Metastasis, Carcinogenesis and genetic predisposition, Diagnostic tests and prognostic factors.

PHRD 6506 **Pharmaceutical Care-IV:** **3**

Osteoarthritis Rheumatoid Arthritis, Dyspepsia, Oncology – Pain Management, Osteoporosis,Inflammatory Bowel Disease, Oncology (didactic/interactive), Patient Interview, Oncology –GI toxicity: Diarrhea, Constipation, Mucositis

Oncology – Nausea & Vomiting, Oncology – Hematological toxicity: Neutropenia & Anemia, Parkinson's Disease Patient Interviews, Stroke / TIA, Parkinson's disease,

PHRD 6507 **Pharmacy Law and Professional Ethics:** **2**

This course focuses on the concepts, working techniques and tools needed to examine and register pharmaceuticals for human use at home and abroad. Drug Act 1940; Drug (Control) Ordinance 1982; Other rules and regulations. Accepted standards of harmonization and technical requirements for the registration of pharmaceuticals for human use; Approval process, format and registration of pharmaceuticals in Bangladesh. This course reviews the recent global developments and trends in all the necessary steps of manufacturing quality pharmaceuticals.

Recommended Books:

Remington's Pharmaceutical Sciences

PHRD 6508 **Non-Prescription Drugs & Self Care:** **3**

A study of various nonprescription pharmaceuticals, medical and surgical supplies and appliances commonly found in ambulatory pharmacy practice sites, their rational use and therapeutic efficacy. Decision-making skills for ambulatory patient triage are emphasized. The use of home remedies and their limitations in the treatment of minor ailments is considered. Variable mixture of lecture, discussions and independent study.

PHRD 6509 **Hospital Pharmacy:** **3**

Hospital pharmacy: Definition, types and classification of hospitals, Organogram of a hospital pharmacy, drug distribution in a hospital, procurement and inventory control, storage and dispensing of controlled drugs, pharmacist role in a hospital

Pharmacy and therapeutic committee: Role, function, organization and operation and policies. Hospital formularies: Definition, formulary contents, guiding principle, evaluating medication for inclusion in formulary, Importance of formulary in a hospital. Emergency medicine Pharmacy practice: Overview, Scope of disease, drug related issues, patient's selection, pharmacy services in emergency department,

Pharmacist role.Medication use evaluation: Definition and types, objective, Organizational body in MUE, steps of MUE, pharmacist's role in MUE

PHRD 6510 **Pharmacoepidemiology :** **3**

Epidemiology And Disease Control is an admirable effort in the collection and reviewing of the recent advances in the preventive of various diseases. Epidemiology and public Health, and has recounted it with clarity of purpose. Many important aspects of epidemiology of cardiovascular diseases, cancer, diabetes, hazards of smoking and others have been described in more detail with some accounts of clinical feature and management. Principles of Epidemiology, Ecology, Agent, Host, Immunity, Environment, Transmission of Infection.

PHRD 6511 **Pharmaceutical Care V:** **3**

Psychiatry, Congestive Heart Failure Overview, Seizure Disorders, Psychiatry Patient Interviews: Schizophrenia and Bipolar Disorder, Depression, Schizophrenia, Bipolar disorder, Anxiety Disorder, Sleep Disorders, Dementia/Alzheimer's Disease, Acute Renal Failure (didactic) Chronic Renal Failure, Alcoholic Liver Disease

PHRD 6512 **Practice Management & Marketing Course:** **3**

This course introduces the students to the basic concepts, styles and tools of pharmaceutical management. Importance; Styles; Improving decision making; Qualities of a manager. Social and legal organizations; Sole proprietorship; General partnership; Public limited company; Private limited company. Personnel management; Principles; Methods; Motivation; Staff requirements theory. Inventory control; Methods; Intuitive; Systematic wantbook; Perpetual inventory; Stock record card; Selection of optimum methods. Purchasing; Effective buying policies; Selecting the sources of supply; Determining terms of purchase; Stocking of goods. This course discusses various aspects of essential marketing operations in a pharmaceutical company. Pricing of drugs: Competitive strategies of pricing; Pricing methods. Market Promotion: Approaches; Developing a promotional plan; Executing the program; Steps in implementation; Advertising of drugs; Direct mail; Personal selling; Miscellaneous promotion; Limiting factors; Evaluation. Advertising: Classification; Primary and selective demand; Strategy; Appraising the opportunity; Media planning; Measuring effectiveness. Market demand and forecasting: Understanding market demand; Anatomy of a market; Patterns; Forecasting and planning; Using multiple forecasting methods.

PHRD 6513 **Pharmacoeconomics:** **3**

BASIC CONCEPTS OF PHARMACOECONOMICS:

Analytical Perspectives , Overview Of Economic Methods , Cost Benefit Analysis - Measuring Benefits And Costs,Direct Cost, Indirect Costs , Intangible Costs, Discount RatesCost-Effective Analysis-Quality Of life Outcomes And Patient Preferences.Decision Analysis, Pharma co economic Consult Form, Checklist And Scoring Form For A Pharma co economic STUDY Discussion. COMMUNITY PHARMACY ECONOMICS AND MANAGEMENT: Economics Of Health Care,The Community Pharmacy-Establishment Of A Community Pharmacy, organization,Unincorporated Sole Proprietorships, Corporations, Site Selection, Capital, Cash, Inventory, Fixtures and Equipment ,Total Investment And Sources Of Capital , Management, The Role Of Management, Facilities , Personnel ,Credit , Risk , Records. DOCUMENTING, BILLING AND REIMBURSEMENT FOR

PHARMACEUTICAL CARE SERVICES: The Role Of Documentation In Pharmaceutical Care, Narrative Documentation: The Soap System Standardized Coding Systems, Limitation Of The PPS Standard, HIPAA And Related Recent Events , Conclusion.

PHRD 6514 **Pharmaceutical Policy and Public Health:** **3**

An introduction to health economics, pharmaceutical policy and public health, including issues of access to and disparities in healthcare and pharmaceuticals, health and disease indicators, health promotion, emergency preparedness, and the involvement of the pharmacist in public health and pharmaceutical policy. Course includes community service experiences.

PHRD 6601 **APPE: Hospital/ Health System Pharmacy:** **6**

The purpose of this pharmacy practice experience is to gain an understanding of the various aspects of health-system pharmacy services.This includes, but is not limited to, provision of products, clinical pharmacy services, and pharmacy management issues. Students should approach the rotation with the understanding that the ultimate goal in all health-system pharmacies is improving patient care.

PHRD 6602 **APPE: Internal Medicine (Adult, Pediatrics, Geriatrics):** **6**

This rotation is designed to provide the student substantial exposure and experience in the comprehensive treatment and inpatient management of the disease states of adult patients that are admitted to the hospital or other institutionalized setting with common acute or chronic conditions (e.g., hypertension, asthma, congestive heart failure, diabetes or infectious diseases). In addition, students utilize problem-solving skills, develop therapeutic plans, monitor lab values, and assess for drug interactions and adverse drug reactions while tracking patients through completion of their therapy.

PHRD 6603 **APPE: Ambulatory Care:** **6**

This experience is designed to give students preparation in treating patients in a general or specialized outpatient setting that are typically not seriously ill. Focus is placed on the medication management of specific diseases (such as hypertension, diabetes, asthma, etc.) or the general care of patients with chronic conditions. Students utilize problem-solving skills, patient medication counseling and therapeutic monitoring, as well as address interaction, side effects and compliance issues in the care of these patients.

PHRD 6604 **APPE: Community Practice:** **6**

This pharmacy practice experience exposes students to the daily clinical activities of the community pharmacy setting, with the focus placed upon a patient care approach. Students learn the goals of clinical intervention and the steps necessary to execute effectively those interventions. Students engage in evaluating and solving drug-related problems, in interacting with the patient, and acting as a primary health care source are stressed.

PHRD 6605 **APPE: Research:** **3**

This rotation allows the student to observe and participate in the research pharmacist's role. Emphasis is placed on how to conduct experiments, analyze data and discuss results. The student continues to build his/her knowledge base in the discipline of the preceptor and gains practical experience in research. Students on this rotation also review journal articles, write a synopsis to further develop their medical writing skills and orally present journal articles.

PHRD 6606 **APPE: In-plant training:** **3**

This rotation allows the student to observe and participate with a pharmacist in the pharmaceutical industry. Emphasis is placed on learning about the industry's role in patient care, where pharmacists can contribute and career opportunities. The student continues to build his/her knowledge base in the discipline of the preceptor.

PHRD 6607 **APPE: Administration:** **3**

This rotation allows the student to observe and participate in the administrative pharmacist's role. Emphasis is placed on how to prepare schedules, assign workloads, check inventory and assess employees. The student continues to build his/her knowledge base in the discipline of the preceptor and gains practical experience in researching and preparing administrative materials. Students on this rotation also review journal articles in the area of administration, write a synopsis to further develop their medical writing skills and orally present journal articles

PHRD 6608 **APPE: Critical Care:** **3**

This pharmacy practice experience is designed to give students preparation in treating patients in a critical care setting. Focus is placed on the medication management of patients in critical condition. Students utilize problem-solving skills, patient medication counseling, therapeutic monitoring, as well as address interaction, side effects and compliance issues in the care of these patients.

PHRD 6609 **APPE: Drug Information:** **3**

This rotation allows the student to serve as a primary provider of drug information in a structured environment that possesses both the resources and the faculty expertise in clinical information management and dissemination. Emphasis is placed on how to receive drug information requests, design and execute a systematic search strategy, assimilate the information retrieved, and formulate and communicate an appropriate response. Students on this rotation also prepare drug monographs and journal articles to further develop their medical writing skills and will orally present journal articles and drug reviews.

PHR 6610 **APPE: Extended Care:** **3**

This experience provides students with the opportunity to learn how to treat illnesses that commonly afflict patients who are housed in an extended-care facility. Students will learn the different treatment options and regimens utilized in this patient population and take into consideration the different pharmacokinetic properties, dosing principles and therapeutic drug monitoring required of this population.

PHRD 6611 **APPE: Rehabilitation:** **3**

This experience provides students with the opportunity to learn how to treat illnesses that commonly afflict patients who are undergoing rehabilitation. Students will learn the different treatment options and regimens utilized in this patient population and take into consideration the different pharmacokinetic properties, dosing principles and therapeutic drug monitoring required of this population.

PHRD 6612 **APPE: Nuclear Pharmacy:** **3**

This rotation allows the student to serve as a primary provider of Nuclear Pharmacist in a structured environment that possesses both the resources and the faculty expertise in this area. Emphasis is placed on how to handle radiopharmaceutical materials on a

daily basis. Nuclear pharmacists will receive extensive training on the various radiopharmaceuticals that they use. They will be trained in radiation safety and other aspects specific to the compounding and preparation of radioactive materials.

PHRD 6613 APPE: Rural Health: 3

This rotation exposes students to the daily clinical activities of the pharmacist practicing in a rural health setting, with the focus placed upon a patient care approach. Students learn the goals of clinical intervention and the steps necessary to execute effectively those interventions. Evaluating and solving drug-related problems, patient interaction and acting as a primary health care source are stressed.