DEPARTMENT OF PHARMACY

Revised SoS of Doctor of Pharmacy (Pharm.D) Program Approved by Pharmacy Council & HEC From Fall 2014 to Onwards

First Professional PHARM-D

Semester 1

Course Code	Course Title	Credit Hours
HUM100	English A (English Comprehension and Composition)	3(3, 0)
PHM101	Pharmaceutical Chemistry IA (Organic I)	4(3, 1)
PHM105	Pharmaceutical Chemistry IIA (Biochemistry)	4(3, 1)
PHM109	Pharmaceutics IA (Physical Pharmacy)	4(3, 1)
PHM113	Physiology A	4(3, 1)
PHM117	Anatomy and Histology	4(3, 1)
Total		**22(17, 5)**

Semester 2

Course Code	Course Title	Credit Hours
HUM103	English B (Communication Skills)	3(3, 0)
PHM102	Pharmaceutical Chemistry IB (Organic II)	4(3, 1)
PHM106	Pharmaceutical Chemistry IIB (Biochemistry)	4(3, 1)
PHM110	Pharmaceutics IB (Physical Pharmacy)	4(3, 1)
PHM114	Physiology B	4(3, 1)
Total		**20(16, 4)**

Second Professional PHARM-D

Semester 3

Course Code	Course Title	Credit Hours
PHM201	Pharmaceutics IIA (Dosage Form Science)	4(3, 1)
PHM205	Pharmacology and Therapeutics IA	4(3, 1)
PHM209	Pharmacognosy IA (Basic)	4(3, 1)
PHM213	Pharmaceutics IIIA (Pharmaceutical Microbiology &Immunology)	4(3, 1)
HUM110	Islamic Studies	3(3, 0)
MTH100	Mathematics I	3(3, 0)
Total		**22(18, 4)**

Semester 4

Course Code	Course Title	Credit Hours
PHM202	Pharmaceutics IIB (Dosage Form Science)	4(3, 1)
PHM206	Pharmacology and Therapeutics IB	4(3, 1)
PHM210	Pharmacognosy IB (Basic)	4(3, 1)
PHM214	Pharmaceutics IIIB (Pharmaceutical Microbiology &Immunology)	4(3, 1)
HUM111	Pakistan Studies	2(2, 0)
PHM118	Biostatistics (Pharmacy Practice I)	3(3, 0)
Total		**21(17, 4)**

Third Professional PHARM-D

Semester 5

Course Code	Course Title	Credit Hours
PHM301	Pathology	4(3, 1)
PHM305	Pharmacology and Therapeutics IIA	4(3, 1)
PHM309	Pharmacognosy IIA (Advanced)	4(3, 1)
PHM313	Pharmaceutical Chemistry IIIA (Pharmaceutical Analysis)	4(3, 1)
PHM317	Pharmacy Practice IIA (Dispensing Pharmacy)	4(3, 1)
Total		**20(15, 5)**

Semester 6

Course Code	Course Title	Credit Hours
PHM302	Pharmacy Practice III (Computer and its Applications in Pharmacy)	4(3, 1)
PHM306	Pharmacology and Therapeutics IIB	4(3, 1)
PHM310	Pharmacognosy IIB (Advanced)	4(3, 1)
PHM314	Pharmaceutical Chemistry IIIB (Pharmaceutical Analysis)	4(3, 1)
PHM318	Pharmacy Practice IIB (Community Pharmacy)	3(3, 0)
Total		**19(15, 4)**

Fourth Professional PHARM-D

Semester 7

Course Code	Course Title	Credit Hours
PHM401	Pharmacy Practice IVA (Hospital Pharmacy)	3(3, 0)
PHM403	Pharmacy Practice VA (Clinical Pharmacy)	4(3, 1)
PHM407	Pharmaceutics IVA (Industrial Pharmacy)	4(3, 1)
PHM411	Pharmaceutics VA (Biopharmaceutics & Pharmacokinetics)	4(3, 1)
PHM415	Pharmaceutics VIA (Pharmaceutical Quality Management I)	4(3, 1)
Total		**19(15, 4)**

Semester 8

Course Code	Course Title	Credit Hours
PHM402	Pharmacy Practice IVB (Hospital Pharmacy)	3(3, 0)
PHM404	Pharmacy Practice VA (Clinical Pharmacy)	4(3, 1)
PHM408	Pharmaceutics VB (Industrial Pharmacy)	4(3, 1)
PHM412	Pharmaceutics VB (Biopharmaceutics & Pharmacokinetics)	4(3, 1)
PHM416	Pharmaceutics VIB (Pharmaceutical Quality Managements)	4(3, 1)
Total		**19(15, 4)**

Fifth Professional PHARM-D

Semester 9

Course Code	Course Title	Credit Hours
PHM501	Pharmaceutical Chemistry IVA (Medicinal Chemistry)	4(3, 1)
PHM505	Pharmacy Practice VIA (Advanced Clinical Pharmacy)	4(3, 1)
PHM509	Pharmaceutics VIIA (Pharmaceutical Technology)	4(3, 1)
PHM513	Pharmacy Practice VIIA (Forensic Pharmacy)	3(3, 0)
PHM515	Pharmacy Practice VIIIA (Pharmaceutical Management and Marketing)	3(3, 0)
Total		**18(15, 3)**

Semester 10

Course Code	Course Title	Credit Hours
PHM502	Pharmaceutical Chemistry IVB (Medicinal Chemistry)	4(3, 1)
PHM506	Pharmacy Practice VIB (Advanced Clinical Pharmacy)	4(3, 1)
PHM510	Pharmaceutics VIIB (Pharmaceutical Technology)	4(3, 1)
PHM514	Pharmacy Practice VIIB (Forensic Pharmacy)	3(3, 0)
PHM516	Pharmacy Practice VIIIB (Pharmaceutical Management and Marketing)	3(3, 0)
Total		**18(15, 3)**

Total Credit Hours: 198

Courses Contents
PharmD

PHM101
Pharmaceutical Chemistry I (Organic)
Course Objectives:-
The objectives of this course are to teach the students basic concepts of organic chemistry related with the pharmaceutical compounds. By studying this course, and performing the lab experiments, the students will also be

able to understand different organic reactions and their mechanisms and will gain knowledge about different named organic reactions and their use in drug design and synthesis.
NOTE: The topics will be taught with special reference to their Pharmaceutical Applications**.**

Theory Course Outline:-
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:

Lab Course Outline:-
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.

Recommended Books
1. A guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman, New York, 6th Ed, 1991.
2. Stereochemistry of Carbon Compounds, E L Eliel, Tata McGraw- Hill, New Delhi, 1992.
3. Organic Chemistry for B.Sc. students, Rehman and M Younis, Ilmi Kitab Khana, Lahore, 1997.
4. Organic Chemistry Vol I, L Finar, Person Education Asia, 6th Ed., New Delhi, 2001.
5. Organic Reaction Mechanism, Raj K Bansel, Tata McGraw-Hill, New Delhi, 1992.
6. Practical Organic Chemistry, 5th Ed., Furaiss Brian, ELBS, London.
7. Guide Book to Mechanism in Organic Chemistry, 6th Ed., Sykes A P, Lonsmen Co, UK, 2008.
8. Basic Principles of organic Chemistry, Roberts J D and Caserio M C, 1990.
9. Introduction to Stereochemistry, Naser-ud-Din, Ghafoor Stationery Mart, Peshawar, 1994.
10 Textbook of Organic Chemistry, Bhal B S, S Chand & Co, New Delhi, 16th 19 Ed., 2007.
11. Organic Chemistry, L.G. Wade, Prentice Hall, New York, U.S.A., 7th Ed., 2010.

PHM102
Pharmaceutical Chemistry IB (Organic)
Course Objectives:-
The objectives of this course are to teach the students stereochemistry and its importance in pharmacy, general methods of preparations, properties, pharmaceutical applications of different classes of organic compounds

and properties of medicinally important heterocyclic compounds. The knowledge gained by the students will help them in understanding the structures of Drug compounds and their pharmacological actions. Further, it will help them to understand the structure-activity relationship of drug compounds and they will be able to understand about drug development and synthesis.

Theory Course Outline:-

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

1. HETEROCYCLIC CHEMISTRY:

i. Preparation and properties of medicinally important Heterocyclic Compounds such as pyrol, furan, thiophene, pyridine, pyrimidine and pyrazine.

ii. Preparation and properties of heterocyclic compounds in which benzo-ring is fused with five and six membered ring containing one hetero atom; Indole, Quinoline and Isoquinoline.

2. REACTION MECHANISM:

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

3. REACTIVE INTERMEDIATE AND FREE RADICALS:

Introduction: Generation, stability and Reaction of the following Intermediates; Carbocations, Carbanions, Carbenes, Nitrenes, Benzynes. Type of reactions: An Overview. Free radicals: Free radical scavengers and their applications.

4. CARBONIUM ION REARRANGEMENTS:

Pinacol-Pinacolone, Wagner-Meerwein, Wolff, Hofmann and Beckmann rearrangements.

5. CARBANIONS:

Condensation reaction (Aldol condensation, Favorskii rearrangement, Wittig rearrangement).

Lab Course Outline:

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

Recommended Books:

1 A guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman, New York, 6th Ed, 1991.
2. Stereochemistry of Carbon Compounds, E L Eliel, Tata McGraw- Hill, New Delhi, 1992.
3. Organic Chemistry for B.Sc. students, Rehman and M Younis, Ilmi Kitab Khana, Lahore, 1997.
4. Organic Chemistry Vol I, L Finar, Person Education Asia, 6th Ed., New Delhi, 2001.
5. Organic Reaction Mechanism, Raj K Bansel, Tata McGraw-Hill, New Delhi, 1992.
6. Practical Organic Chemistry, 5th Ed., Furaiss Brian, ELBS, London.
7. Guide Book to Mechanism in Organic Chemistry, 6th Ed., Sykes A P, Lonsmen Co, UK, 2008.
8. Basic Principles of organic Chemistry, Roberts J D and Caserio M C, 1990.
9. Introduction to Stereochemistry, Naser-ud-Din, Ghafoor Stationery Mart, Peshawar, 1994.
10 Textbook of Organic Chemistry, Bhal B S, S Chand & Co, New Delhi, 16th 19 Ed., 2007.
11. Organic Chemistry, L.G. Wade, Prentice Hall, New York, U.S.A., 7th Ed., 2010.

PHM105

Pharmaceutical Chemistry IIA (Biochemistry)

Course Objectives:-

Aims of teaching Biochemistry to Pharmacy student in the form of lectures include acquiring knowledge in the field of living organisms' functions on the basis of their molecular structure and metabolism. This would constitute basis for understanding the mechanisms of activity and metabolism of drugs, biotechnological methods in drug discovery, biosynthesis, analysis and therapy, and differentiation of normal and pathological states of human being.

Theory Course Outline:-

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.)

i. Carbohydrates: Chemistry, Classification, Reactions of Carbohydrates, Optical activity, Biological and pharmaceutical importance of carbohydrates.

ii. 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.

iii. 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.

iv. 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.

v. Vitamins: Chemistry, Classification (Fat-soluble and water-soluble vitamins), Biological and pharmaceutical importance of vitamins.

vi. Hormones: Chemistry, Classification (Proteinous and nonproteinous hormones, amino acid derivatives, steroids), Biological and pharmaceutical importance of hormones.

vii. 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).

Lab Course Outline:-

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.

Recommended Books:

1. Medical Biochemistry, 7th Ed, M N Chaterjea, Jaypee Brothers Medical Publishers, New Delhi, 2007.

2. Harper's Biochemistry, 28thEd, Roberk Murray, Daryl K, Granner, Peter A Mayes, Victor W Rodwell Appleton and Lange, Lange Medical Publications, New York, 2009.

3. Principles of Biochemistry, 4th Ed, Albert L Lehninger CBS Publisher, Delhi, 2004.

4. Biochemistry, 5th Ed, Lubert Stryer, W H Freeman and Company, 2002.

5. Illustrated Biochemistry, 4th Ed, Pamela C Champe, Richard A Harvey J, Lippincot Company, 2007.

6. Harper's Biochemistry, 26th Ed, Print-Hall, New Jersey, 2003.

7. Biochemistry, M Rafiq, The Carvan Book House, Lahore, 1st Ed.
8. Clinical Chemistry, Montogomary, the C V Mosby Company, 5th Ed.
9. Outlines of Biochemistry, Conn and Stumpf, John Willey & Sons, New York, 5th Ed., 1999.
10. Principles of Biochemistry, 4th Ed, Lehninger, Worth Publishers Co, New York. 2004
11. Essentials of Medical Biochemistry, Ahmed M, Merit Pub Fasilabad, 1991.
12. Text Book of Biochemistry, West E S, Todd R W and Van Bruggen T J, The MacMillan Co, 1996.

PHM106
Pharmaceutical Chemistry IIB (Biochemistry)
Course Objectives:-
The main objectives of teaching this course to pharmacy students include acquiring knowledge in the field of living organisms' functions on the basis of their molecular structure and metabolism. This would help the students to understand the mechanisms of activity and metabolism of drugs, biotechnological methods in drug discovery, biosynthesis, analysis and therapy, and differentiation of normal and pathological states of human being.

Theory Course Outline:-
1. METABOLIC FATE OF BIOMOLECULES (Anabolism and Catabolism):
a. Carbohydrates: Brief introduction to the digestion and absorption of carbohydrates, Aerobic and anaerobic breakdown of Glucose, Glycolysis, Pentose Phosphate Pathway, Glycogenolysis, Glycogenesis, Gluconeogenesis, Citric acid cycle, Energetics of various metabolic processes.

b. Lipids: Brief introduction to the digestion and absorption of lipids, Oxidation of fatty acids through β-oxidation, Biosynthesis of fatty acids, neutral lipids and cholesterol.

c. Proteins and Amino acids: Brief introduction to the digestion and absorption of proteins and amino acids, Metabolism of essential and non-essential amino acids, Biosynthesis and catabolism of Haemins and porphyrin compounds.

d. Bioenergetics: Principles of bioenergetics, Electron transport chain and oxidative phosphorylation.

2. REGULATION OF METABOLIC PROCESSES:
a. Role of Vitamins: Physiological role of Fat-soluble (A, D, E and K) and Water-soluble (Thiamin, Riboflavin, Pantothenic acid, Niacin, Pyridoxal phosphate, Biotin, Folic acid, Cyanocobalamin-members of B-complex family and Ascorbic acid), Coenzymes and their role in the regulation of metabolic processes.

b. Receptor Mediated regulation (Hormones): Mechanism of action of hormones, Physiological roles of various hormones, Site of synthesis and target sites of hormones.

c. Secondary Messengers: Role of cAMP, Calcium ions and phosphoinositol in the regulation of metabolic processes.

d. Gene Expression: Replication, Transcription and Translation (Gene expression) Introduction to Biotechnology and Genetic Engineering, Basic principles of Recombinant DNA technology, Pharmaceutical applications, Balance of Catabolic, Anabolic and Amphibolic processes in human metabolism, Acid-Base and Electrolyte Balance in Human body.

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

Lab Course Outline:-

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

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

Recommended Books:

1. Medical Biochemistry, 7th Ed, M N Chaterjea, Jaypee Brothers Medical Publishers, New Delhi, 2007.
2. Harper's Biochemistry, 28thEd, Roberk Murray, Daryl K, Granner, Peter A Mayes, Victor W Rodwell Appleton and Lange, Lange Medical Publications, New York, 2009.
3. Principles of Biochemistry, 4th Ed, Albert L Lehninger CBS Publisher, Delhi, 2004.
4. Biochemistry, 5th Ed, Lubert Stryer, W H Freeman and Company, 2002.
5. Illustrated Biochemistry, 4th Ed, Pamela C Champe, Richard A Harvey J, Lippincot Company, 2007.
6. Harper's Biochemistry, 26th Ed, Print-Hall, New Jersey, 2003.
7. Biochemistry, M Rafiq, The Carvan Book House, Lahore, 1st Ed.
8. Clinical Chemistry, Montogomary, the C V Mosby Company, 5th Ed.
9. Outlines of Biochemistry, Conn and Stumpf, John Willey & Sons, New York, 5th Ed., 1999.
10. Principles of Biochemistry, 4th Ed, Lehninger, Worth Publishers Co, New York. 2004
11. Essentials of Medical Biochemistry, Ahmed M, Merit Pub Fasilabad, 1991.
12. Text Book of Biochemistry, West E S, Todd R W and Van Bruggen T J, The MacMillan Co, 1996.

PHM109
Pharmaceutics IA (Physical Pharmacy)
Course Objectives:

The objectives of this course are to give the students an exposure about the basic terminologies & techniques used in the field of pharmacy, knowledge about history and origin of pharmacy, different types and properties of pharmaceuticals and knowledge about physicochemical processes used in different pharmaceutical procedures. The knowledge gained in this course will help the students to understand in better way the advance pharmaceutics courses.

Theory Course Outline:

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:

i. 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.
ii. An introduction of various official books.

3. PHYSICO-CHEMICAL PRINCIPLES:

i. 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.
ii. Solubilisation: Factors affecting solubility. Surfactants, their properties and types. Micelles; their formulation and types.
iii. Adsorption: Techniques and processes of adsorption in detail.

iv. Ionization: pH, pH indicators, pka, buffers, buffer's equation, isotonic solutions and their applications in pharmacy.
v. Hydrolysis: Types and protection of drugs against hydrolysis.
vi. Micromeritics: Particle size, shapes and distribution of particles. Methods of determination of particle size and importance of particle size in Pharmacy.

4. DISPERSIONS:

i. 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.
ii. Emulsions: Types, theories of emulsification, emulsifying agents their classification and stability of emulsion.

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

Lab Course Outline:-

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.

Recommended Books:

1 Physical Pharmacy, Martin, B I Waverly PVT, Delhi, 5th Ed., 2005.
2. Tutorial Pharmacy, 6th Ed, Cooper and Gunns, CBS Publishers & Distributors, New Delhi, 2005.
3. Bentley's Pharmaceutics, All India Traveler Book Seller, New Delhi, 1996.
4. Physical & Chemical Principles of Pharmaceutical Science, AHC, 6th Ed., Martin P, Bustamante P and Chun, New York, 1999.
5. Advances in Pharmaceutical Sciences. Vol 7, Martin AMN, Banker G S and Chun AHC, Academic Press, London, 1995.
6. Rheology of disperse systems. Mill C C Casson,N. Pergamon Press, New York, 1975.
7. Rheology. Rienger M and Scott-Blair. G W, Academic Press, London, 1990.
8. Advances in Pharmaceutical Sciences, Barry B W, Academic Press, London, 1990.
9. Emulsion Science, Sherman P, Martin A, Swarbrick J and Cammatra A, Academic Press, London, 1972.
10. Physical Pharmacy, 3rd Ed., Lee & Febiger, Philadelphia. 1983.
11. Surfactant Systems. Attwood D and Flocence A T, Chapman and Hall Ltd, London, 1982.

PHM110
Pharmaceutics IB (Physical Pharmacy)
Course Objectives:-

The objectives of this course are to give the students an exposure about the basic terminologies, techniques used in the field of pharmacy, knowledge about history and origin of pharmacy, different types and properties of pharmaceuticals and knowledge about physicochemical processes used in different pharmaceutical procedures. Students will also learn how to develop skills and techniques that are parts of pharmaceutical procedures through the actual use of equipment and instruments.

Theory Course Outline:

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

2. PHYSICOCHEMICAL PROCESSES:

i. Precipitation: Process of precipitation and its applications in Pharmacy.

ii. Crystallization: Types of crystals, Mechanism and methods of crystallization and its applications in Pharmacy.

iii. Distillation: Simple distillation, fractional distillation, steam distillation, vacuum distillation, destructive distillation and their applications in Pharmacy.

iv. Miscellaneous Processes: Efflorescence, deliquescence, lyophillization, elutrition, exiccation, ignition, sublimation, fusion, calcination, adsorption, decantation, evaporation, vaporization, centrifugation, dessication, levigation and trituration.

3. EXTRACTION PROCESSES:

i. Maceration: Purpose & process.

ii. Percolation: Purpose and Process.

iii. Liquid-Liquid extraction: Purpose and Process.

iv. Large scale extraction: Purpose and Process.

4. RATE AND ORDER OF REACTIONS.

5. KINETIC PRINCIPLES AND STABILITY TESTING:
THEORETIC CONSIDERATIONS: Degradation:

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

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

Lab Course Outline:-

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.

i. Partition-coefficient, surface tension, viscosity.

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

Recommended Books:

1. 1 Physical Pharmacy, Martin, B I Waverly PVT, Delhi, 5th Ed., 2005.
2. Tutorial Pharmacy, 6th Ed, Cooper and Gunns, CBS Publishers & Distributors, New Delhi, 2005.
3. Bentley‘s Pharmaceutics, All India Traveler Book Seller, New Delhi, 1996.
4. Physical & Chemical Principles of Pharmaceutical Science, AHC, 6th Ed., Martin P, Bustamante P and Chun, New York, 1999.
5. Advances in Pharmaceutical Sciences. Vol 7, Martin AMN, Banker G S and Chun AHC, Academic Press, London, 1995.
6. Rheology of disperse systems. Mill C C Casson,N. Pergamon Press, New York, 1975.
7. Rheology. Rienger M and Scott-Blair. G W, Academic Press, London, 1990.
8. Advances in Pharmaceutical Sciences, Barry B W, Academic Press, London, 1990.
9. Emulsion Science, Sherman P, Martin A, Swarbrick J and Cammatra A, Academic Press, London, 1972.
10. Physical Pharmacy, 3rd Ed., Lee & Febiger, Philadelphia. 1983.
11. Surfactant Systems. Attwood D and Flocence A T, Chapman and Hall Ltd, London, 1982.

PHM113

Physiology A
Course Objectives:

In this course students will be taught the general principles and functions of human body with emphasis on practical applications and basic physiological consideration of different systems of human body. Functional study of different organs and their inter-relationship and basic histological study of human cells and different organs is another important objective which will help the students to understand the phenomenon of drug absorption and activity.

Theory Course Outline:-

1. BASIC CELL FUNCTIONS:

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

ii. Cell structure: Microscopic Observation of Cell, Microscopic, Cell Organelles, Cytoskeleton.

iii. 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.

iv. Genetic information and Protein Synthesis: Genetic Code, Protein Synthesis, Protein, Degradation, Protein Secretion, Replication and Expression of Genetic Information, Cancer, Genetic Engineering.

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

2. BIOLOGICAL CONTROL SYSTEM:

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

ii. 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.

iii. 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.

iv. 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.

v. 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.

vi. 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.

vii. 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.

Lab Course Outline:

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.

Recommended Books:
1. Text Books of Medical Physiology, Arthur C Guyton, MD, WB Saunders Company, Ninth Ed., 2011.
2. Human Physiology by Vander Sharma &Lucino 9th Ed. McGraw Hill, 2003
3. Human Physiology by S.I. Fox 11th Ed. Amazon, 2009.
4. Review of Medical Physiology, William F Ganong, Prentice Hgall International Inc, seventeenth edition, 1995.
5. Human Physiology, Chandi Charan Chatterjee, Medical allied agency, 1994.
6. Samson Wright‘s Applied Physiology. Revised by Cyril AKeele and Eric Neil.
7. Human Anatomy and Physiology, Spence AP and Mason EB, Beajamin/ Cumming Publishing Inc. California, 3rdEd.
8. Clinical Anatomy for Medical Students, Snell RS, Litle Brown & Co Inc, USA. 1992.

PHM114
Physiology B
Course Objectives:-

In Physiology part of these paper students will be taught the general principles of functions of human body with emphasis on basic physiological consideration of different systems of human body. Functional study of different organs and their inter-relationship and basic histological study of human cells and different organs is another important objective. The Histology part of this course will help to make students learn about different tissues in the human body and give comprehensive account of their morphology. Furthermore, it will enable the students to learn different histological terms and concepts.

Theory Course Outline:-

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

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

iii. The kidneys and Regulation of Water and Inorganic Ions: Renal Functions, Structure of the Kidneys and Urinary System, Basic Renal Process, The Concept of Renal Clearance Micturition, Total Body Balance of sodium and Water Basic Renal Process for sodium and Water, Renal Sodium Regulation, Renal Water regulation, A Summary Example: the response to Sweating, Thirst and Salt Appetite, Potassium Regulation, Effector Sites for Calcium Homeostasis, Hormonal controls, Metabolic Bone Disease, Source of Hydrogen Ion gain or

loss, Buffering of Hydrogen Ions in the Body, Integration of Homeostatic Controls, Renal Mechanisms, Classification of Acidosis and Alkalosis, Diuretics, Kidney Disease.

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

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

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

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

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

Lab Course Outline:-

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Experimental Physiology includes;
1. BLOOD: Determination of Haemoglobin (Hb), Determination of ESR, RBC Count, WBC Count, DLC (Differential Leucocyte Count), Bleeding Time, Coagulation Time and Blood groups.

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

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

Recommended Books:

1. Text Books of Medical Physiology, Arthur C Guyton, MD, WB Saunders Company, Ninth Ed., 2011.
2. Human Physiology by Vander Sharma &Lucino 9th Ed. McGraw Hill, 2003
3. Human Physiology by S.I. Fox 11th Ed. Amazon, 2009.
4. Review of Medical Physiology, William F Ganong, Prentice Hgall International Inc, seventeenth edition, 1995.
5. Human Physiology, Chandi Charan Chatterjee, Medical allied agency, 1994.
6. Samson Wright's Applied Physiology. Revised by Cyril AKeele and Eric Neil.
7. Human Anatomy and Physiology, Spence AP and Mason EB, Beajamin/ Cumming Publishing Inc. California, 3rdEd.
8. Clinical Anatomy for Medical Students, Snell RS, Litle Brown & Co Inc, USA. 1992.

PHM117

Anatomy and Histology
Course Objectives:-

In this course emphasis is given to anatomy of different organs of human body. The students are familiarized with basic structures, location of different organs which play a role in the normal function of human body and applied aspects of developmental, gross and microscopic anatomy without burdening the students with unnecessary details of basic anatomy. Efforts are made to demonstrate anatomical facts of practical importance through models, prospected parts, films and slides. Also the teaching of developmental, gross and microscopic anatomy is taught concurrently.

The Histology part of this course will allow the students to learn about different tissues in the human body and give comprehensive account of their morphology.

Course Outline:-

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,

i. Epithelial Tissue: General characters, classification.

ii. Connective Tissue: Structure & types; (Connective tissue, Cartilage).

iii. Bones: Structure and types of bones and joints.

iv. Muscle: Structure of skeletal muscle, smooth muscle, cardiac muscle.

4. INTEGUMENTARY SYSTEM:

i. Skin: Structure (Epidermis, dermis).

ii. Glands of Skin: (Sweat, Sebaceous).

iii. Hair: Structure, function.

iv. Nail: Structure, function

5. CARDIOVASCULAR SYSTEM:

i. Heart: Structure of Heart, Location of Heart, Blood Supply to Heart.

ii. 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:

i. Pituitary gland: structure and relation to hypothalamus.

ii. Thyroid gland: structure.

iii. Adrenal gland: structure.

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

i. Brain: Meninges (Cerebrum: cerebral Lobes. Ventricals, Cerebellum—Anatomy of Cerebellum, Brain Stem: MidBrain. Pons. MEdulla Oblongata, Diencephalon. Thalamus Hypothalamus and Cranial Nerves).

ii. 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:

i. Underlying principles of histological techniques and staining specific tissues should be explained.

ii. Staining of paraffin and frozen sections will be given to the students.

Iii. Most of the teaching should be done on stained and mounted sections and every type of normal tissue will be covered.

Lab Course Outline:-

Anatomy and Histology:

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.

Recommended Books:

Anatomy

1. Manual of Practical Anatomy. Romanes G J, Cunningham‘s, Humphary Kalfom, Oxford, Oxford University Press, London, 3 volumes, 1996.
2. Gray‘s Anatomy, Descriptive and Applied, 21st Ed, Longman‘s Green & Co, London, 1996.
3. Textbook of Anatomy. J G Romanes, London. Cunningham‘s Oxford University Press, 1996.
4. Clinical Anatomy, 7th Ed, Snell R S, Boston, Little, Brown and Company, 2003.
5. Clinically Oriented Human Anatomy. Keith L More and TVN Persaud, W B Saunders, Philadelphia,1996.
6. A Method of Anatomy, 9th Ed, B Grant, Bailliere Tinal and Co, Ltd, London. 1975
7. A textbook of Anatomy, 2nd Ed, W J Hamilton, Macmillan and Co, London. 1976.
8. Anatomy, Regional and Applied, 11th Ed, R J Last, J and A Churchill Ltd, London. 2001.

Histology

1. Textbook of Histology, Bradbury S, Hewer‘s, ELBS, London, 1984.
2. Tissues of the body by Legros Clerks. Reference Book: Publisher Oxford at the Clarendon Press, London.
3. Essential Histology, 2nd Ed, Cormack H D, J B Lippincott Co, Philadelphia, 1993.
4. Histology; color atlas of microscopic anatomy, 3rd Ed, . Hammersen F, Lee & Febijer Co, Pennsylvania, 1985.

PHM201
Pharmaceutics IIA (Dosage Form Science)
Course Objectives:

The objective of this course is to expose pharmacy students to understand the concept of different dosage forms used in pharmacy practice. The students will also be able to learn about the use of different ingredients, their small and large scale preparation, and their role in the community pharmacy practices.

Theory Course Outline:

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

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

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

4. SOLVENTS USED IN PHARMACEUTICAL PREPARATIONS:

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

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

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

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

Lab Course Outline:

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

Recommended Books:

1. Pharmaceutics, Michel E Aulton, ELBS/Churchill Livingstone, London, 1998.
2. Bentley's Book of Pharmaceutics, CBS Publishers & Distributors, New Delhi, 1986.
3. Pharmaceutics, The Science of Dosage Form Design. 2nd Ed., HawCourt Publisher, 2002.
4. Berdley's Textbook of Pharmaceutics, edited by 8th (or recent edition) E A Rawlins, Macmillan Publishing Co Inc, New York, 1977.
5. Sprowl's American Pharmacy,7th Ed, J B Lippincott Co, 1990.

PHM202
Pharmaceutics IIB (Dosage Form Science)
Course Objectives:-

The objective of this course is to expose pharmacy students to the concepts and delivery of different dosage forms

used in pharmacy and the use of different ingredients, their small and large scale preparation, and their role in the pharmacy practices.

Theory Course Outline: -

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

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

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

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

5. A BRIEF INTRODUCTION TO ORAL HYGIENE PRODUCTS:

Lab Course Outline:

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

Recommended Books:

1. Pharmaceutics, Michel E Aulton, ELBS/Churchill Livingstone, London, 1998.

2. Bentley‘s Book of Pharmaceutics, CBS Publishers & Distributors, New Delhi, 1986.

3. Pharmaceutics, The Science of Dosage Form Design. 2nd Ed., HawCourt Publisher, 2002.

4. Berdley‘s Textbook of Pharmaceutics, edited by 8th (or recent edition) E A Rawlins, Macmillan Publishing Co Inc, New York, 1977.

5. Sprowl‘s American Pharmacy,7th Ed, J B Lippincott Co, 1990.

PHM205
Pharmacology and Therapeutics IA
Course Objectives:-

This course will help to develop among students the basic understanding of the subject of Pharmacology. Students will be able to know that pharmacologically, drugs and or chemicals are studied from two main aspects; pharmacokinetics and pharmacodynamics and trying to explore that how a drug acts. In its entirety, pharmacology embraces knowledge of the sources, chemical properties, biological effects and therapeutic uses of drugs. Pharmacological studies will range from those that examine the effects of chemical agents on subcellular mechanisms, to those that deal the treatment and prevention of diseases with drug therapy and with the potential hazards of toxic substances. Pharmacologists also use molecular modeling and computerized design as drug discovery tools to understand cell function. New pharmacological areas include the genomic and proteomic approaches for therapeutic treatments.

Theory Course Outline:

1. GENERAL PHARMACOLOGY:

i. Pharmacology: Definition of Pharmacology, history and its various branches. Definition of Drug and its various sources.

ii. Routes of drug administration, advantages and disadvantages.

iii. Pharmacokinetics: Drug solubility and passage of drug across the biological membranes. Absorption, distribution, metabolism and elimination of drugs and factors affecting them. Various pharmacokinetic parameters including volume of distribution (Vd), clearance (Cl), Biological half life (t1/2β) Bioavailability and various factors affecting it. Dose, Efficacy and Potency of drugs. Hypersensitivity and Idiosyncratic reactions, drug tolerance and dependence. Drug interactions. Plasma protein binding.

iv. Pharmacodynamics: How drugs act? Receptors and their various types with special reference to their molecular structures. Cell surface receptors, signal transduction by cell surface receptors, signaling Mediated by intra cellular receptors, target cell and hyper sensitization, Pharmacological effects not Mediated by receptors (for example anesthetics and cathartics) Ion channel, enzymes, carrier proteins, Drug receptor interactions and theories of drug action. Agonist, antagonist, partial agonist, inverse agonist. Receptors internalization and receptors co-localization. Physiological Antagonism, Pharmacological Antagonism (competitive and non-competitive), Neutralization Antagonism, Neurotransmission and neuro-modulation. Specificity of drug action and factors modifying the action & dosage of drugs. Median lethal dose (LD:50), Median effective dose (ED:50) and Therapeutic Index, Dose-response relationships.

2. DRUGS ACTING ON AUTONOMIC NERVOUS SYSTEM (ANS):

i. Organization of ANS its subdivisions and innervations.

ii. Neurotransmitters in ANS, their synthesis, release and fate.

iii. Sympathetic agonists: Catecholamines and Noncatecholamines.

iv. Sympathetic antagonists: Adrenergic receptor Blockers and neuron blockers.

v. Parasympathetic (Cholinergic) agonists and cholinesterase enzyme inhibitors (anticholinesterases) Parasympathetic antagonists.

vi. Ganglion stimulants and Ganglion blockers

vii. Neuromuscular Blockers

3. DRUGS ACTING ON GASTROINTESTINAL TRACT:

i. Emetic and anti-emetics

ii. Purgatives

iii. Anti-diarrheal agents

iv. Treatment of Peptic & duodenal ulcer: Antacids, H2-Receptor antagonists, antimuscarinic agents, proton pump inhibitors, prostaglandin antagonists, gastrin receptor antagonist and cytoprotective agents

v. Drug treatment of chronic inflammatory bowel diseases

vi. Drugs affecting bile flow and Cholelithiasis

NOTE:

1. Only an introduction will be given of the banned and obsolete drug products.

2. While dealing with Pharmacology stress should be laid to the group actions of related drugs and only important differences should be discussed of the individual drugs placed in same group.

3. Newly introduced drugs should be included in the syllabus while drugs with no clinical and therapeutic values ought to be excluded from syllabus at any time.

4. The prototype drugs in each group from the latest edition of the recommended books.

Lab Course Outline:

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

1. Preparation of standard solution, Ringers' solution, Tyrode solution, Kreb solution, Normal saline.
2. To demonstrate the effects of sympathomimetic (Adrenaline) and sympatholytic drugs (Propranolol) on Frog's heart.
3. To demonstrate the effects of parasympathomimetic (Acetylcholine) and parasympatholytic (Atropine) drugs on Frog's heart.
4. To demonstrate the effects of an unknown drug on Frog's heart. Routes of Administration of drugs.
5. To demonstate the effects of vasconstrictor drugs on Frog's blood vessels.
6. To demonstrate the effects of stimulant drugs on Rabbit's intestine (Acetyl choline, Barium chloride). To demonstrate the effects of depressant drugs on Rabbit's intestine (Atropine).
7. To differentiate the effects of an unknown drug on Rabbit's intestine and identify the (unknown) drug. To study the effects of Adrenaline on Rabbit's Eyes.
8. To study the effects of Homatropine on Rabbit's Eyes.
9. To study the effects of Pilocarpine on Rabbit's Eyes.
10. To study the effects of Local Anaesthetic drug (e.g Cocaine) on Rabbit's Eyes.
11. To identify the unknown drug & differentiate its effects on Rabbit's Eyes.
12. To demonstrate emetic effects of various drugs in pigeons

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

Recommended Books:

1. Pharmacological basis of Therapeutics. 11th Ed, Goodman Gilman, McGraw-Hill Book Company, New York, 2008.
2. Human Pharmacology, Winguard and Brody's, Mosby Year Book, Boston, 1991.
3. A Text book of Clinical Pharmacology, 5th Ed James M Ritter and Lionel De Levis, Oxford University Press, New York, 2008.
4 Pharmacology and Pharmacotherapeutics, 19th Ed, . R S Satorkar and S D Bhandarkar, Popular Prakashan, Bomby, 1998.
5. Essential of Medical Pharmacology, J D Tripathy, Japees Brother, New Delhi, 6th Ed., 2008.
6. Clinical Pharmacology, D R Laurence, ELBS, London, 8th Ed., 1998.
7. Basic and Clinical Pharmacology, Katzung B G, McGraw-Hill Medical Publishers, New York, 11th Ed., 2009.
8. Pharmacology, 4th Ed, Lippincott, Lippincott William & Wilkins, USA, 2008.
9. Pharmacology, Manuchair Ebadi, Little Brown & Company, London, 1993
10. Basic and Clinical Pharmacology, Bertram G K, Paramount Publishing Business & Professional Group, USA, 10th Ed., 2007.
11. Review of Medical physiology, 22nd Ed, William F Ganong, W F, Prentice Hall International Inc, New Jersey, 2005
12. Fundamentals of Experimental Pharmacology. Qayum A, Ghandhara University, Peshawar, 2004.
13. Humphrey P. Rang, Rang & Dale's Pharmacology, 6th Ed, 2007.

PHM206
Pharmacology and Therapeutics IB
Course Objectives:-

This course will enable the students to understand the pharmacological effects of different classes of drugs on different body systems. Pharmacological studies will range from those that examine the effects of chemical agents on subcellular mechanisms, to those that deal the treatment and prevention of diseases with drug therapy and with the potential hazards of toxic substances. Pharmacologists also use molecular modeling and computerized design as drug discovery tools to understand cell function.

Theory Course Outline:-

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

2. DRUGS ACTING ON RESPIRATORY SYSTEM:

i. Drugs used in cough (Anti-tussives, Expectorants and Mucolytic agents).

ii. Drugs used in Bronchial Asthma. Bronchodilators: Sympathomimetic, Xanthine derivatives, Leukotriene receptor antagonists and synthesis inhibitors, Muscarinic receptor antagonists, Cromoglycate, Nedocromil, Cortecosteroids & other Anti-inflammatory drugs.

3. DRUGS ACTING ON CARDIO-VASCULAR SYSTEM:

i. Angina pectoris and its drug treatment

ii. Congestive heart failure & its treatment.

iii. Anti-arrhythmic drugs

iv. Anti-hyperlipidemic.

v. Coagulants and Anti-coagulants

vi. Anti-hypertensive

vii. Diuretics

4. DRUGS ACTING ON GENITOURINARY SYSTEM: Oxytocin, Ergot alkaloids and uterine relaxants.

5. ANTI-ANAEMIC DRUGS.

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

NOTE:
1. Only an introduction will be given of the banned and obsolete drug products.

2. While dealing with Pharmacology stress should be laid to the group actions of related drugs and only important differences should be discussed of the individual drugs placed in same group.

3. Newly introduced drugs should be included in the syllabus while drugs with no clinical and therapeutic values ought to be excluded from syllabus at any time.

4. The prototype drugs in each group from the latest edition of the recommended books.

Lab Course Outline:-

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

1. Preparation of standard solution. Ringer solution. Tyrode solution. Kreb solution. Normal saline.
2. To demonstrate the effects of sympathomimetic (Adrenaline) &sympatholytic drugs (Propranolol) on Frog's heart.
3. To demonstrate the effects of parasympathomimetic (Acetylcholine) and parasympatholytic (Atropine) drugs on Frog's heart.
4. To demonstrate the effects of an unknown drug on Frog's heart.
5. Routes of Administration of drugs.
6. To demonstate the effects of vasconstrictor drugs on Frog's blood vessels.
7. To demonstrate the effects of stimulant drugs on Rabbit's intestine (Acetyl choline, Barium chloride).
8. To demonstrate the effects of depressant drugs on Rabbit's intestine (Atropine).
9. To differentiate the effects of an unknown drug on Rabbit's intestine and identify the (unknown) drug.
10. To study the effects of Adrenaline on Rabbit's Eyes.
11. To study the effects of Homatropine on Rabbit's Eyes.
12. To study the effects of Pilocarpine on Rabbit's Eyes.
13. To study the effects of Local Anaesthetic drug (e.g Cocaine) on Rabbit's Eyes.
14. To identify the unknown drug & differentiate its effects on Rabbit's Eyes

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

Recommended Books:

1. Pharmacological basis of Therapeutics. 11th Ed, Goodman Gilman, McGraw-Hill Book Company, New York, 2008.
2. Human Pharmacology, Winguard and Brody's, Mosby Year Book, Boston, 1991.
3. A Text book of Clinical Pharmacology, 5th Ed James M Ritter and Lionel De Levis, Oxford University Press, New York, 2008.
4 Pharmacology and Pharmacotherapeutics, 19th Ed, . R S Satorkar and S D Bhandarkar, Popular Prakashan, Bomby, 1998.
5. Essential of Medical Pharmacology, J D Tripathy, Japees Brother, New Delhi, 6th Ed., 2008.
6. Clinical Pharmacology, D R Laurence, ELBS, London, 8th Ed., 1998.
7. Basic and Clinical Pharmacology, Katzung B G, McGraw-Hill Medical Publishers, New York, 11th Ed., 2009.
8. Pharmacology, 4th Ed, Lippincott, Lippincott William & Wilkins, USA, 2008.
9. Pharmacology, Manuchair Ebadi, Little Brown & Company, London, 1993
10. Basic and Clinical Pharmacology, Bertram G K, Paramount Publishing Business & Professional Group, USA, 10th Ed., 2007.
11. Review of Medical physiology, 22nd Ed, William F Ganong, W F, Prentice Hall International Inc, New Jersey, 2005
12. Fundamentals of Experimental Pharmacology. Qayum A, Ghandhara University, Peshawar, 2004.
13. Humphrey P. Rang, Rang & Dale's Pharmacology, 6th Ed, 2007.

PHM209
Pharmacognosy IA (Basic)
Course Objectives:-

In this course the teaching of Pharmacognosy in pharmacy is aimed at different aspects of crude drugs, their cultivation, identification, collection, evaluation and other processes from plants and animals. This also includes the different systems of classification of crude drugs. Besides these some other topics like allergenic preparations, enzymes, poisonous plants and pesticides from biological sources are also studied. It also covers the study of different systems of medicines which will help the students to understand the concepts of drug development from plant origin and importance of Medicinal Plants in Pharmacy.

Theory Course Outline:

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

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

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

S. No.	Families	Crude Drugs
i.	Ranunculaceae	*Aconitum, Larkspur, Pulsatilla, Hydrastis*
ii.	Papaveraceae	*Papaver somniferum, Sanguinaria, Canadensis*
iii.	Leguminosae	*Acacia, Glycyrrhiza, Senna, Cassia, Tamarind*
iv.	Umbelliferae	*Fennel, Carum, Coriander, Conium, Asafoetida*
v.	Apocynaceae	*Rauwolfia, Catharanthus*
vi.	Asclepiadaceae	*Gymnema sylvestre, Calotropis gigantea*
vii.	Compositae	*Artemisia, Silybum marianum, Echinaceae, Arctium lappa*
viii.	Solanaceae	*Belladonna, Hyoscyamus, Stramonium, Capsicum*

ix.	Scrophulariaceae	*Digitalis, Verbascum (Mullien).*
x.	Labiatae	*Peppermint, Thyme, Spearmint, Salvia, Ocimum*
xi.	Liliaceae	*Garlic, Colchicum, Aloe*

4. EVALUATION AND ADULTRATION OF CRUDE DRUGS: Evaluation of crude drugs i.e., Organoleptic, Microscopic, Physical, Chemical and Biological. Deterioration and Adulteration of crude drugs. Types of adulteration, inferiority, spoilage, admixture, sophistication and substitution of crude drugs.

Lab Course Outline:-

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters) and Microscopic examination of powders and sections of plant drugs. (Note: A minimum of 10 practicals will be conducted). A Study Tour will be an integral part of the syllabus and will be arranged at the end of the session for collection of medicinal plants from the country.

Recommended Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York 1955-1977.
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers 2000.
3. Ayurvedic Pharmacognosy, Partab Chauhan, Ed., Sonali Publications, New Delhi 2007.
4. Vitamins in Medicine, Vol. 1-2 Baker B.M. and Bender D.A. 1980-82
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York, 2000.
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York 1981.
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart 1994.
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, 200).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester, 1997.
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa, 2003.
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad, 2003.
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London, 2007.
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia 2001.
14. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, 1988.
15. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, 2005.
16. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester, 1999.
17. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol, 1975.

18. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher, 2009.
19. Pharmacognosy, 9th ed., Tyler V.E., Brady E.R. and Robbers J.E. Lea & Febiger, Philadelphia 1988.

PHM210
Pharmacognosy IB (Basic)
Course Objectives

The teaching of this Pharmacognosy course in pharmacy is aimed at different aspects of crude drugs, their cultivation identification, collection, evaluation and other processes from plants and animals. This also includes the different systems of classification of crude drugs. Besides these some other topics like allergenic preparations, enzymes, poisonous plants and pesticides from biological sources are also studied. It also covers the study of different systems of medicines. After completing this course students will be able to understand different both beneficial and adverse effects of medicinal plants.

Theory Course Outline:-

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

2. BIOLOGICS: Sources, structure, preparation, description and uses of vaccines, toxins, antitoxins, venoms, antivenoms, antiserums.

3. SURGICAL DRESSINGS: Classification of fibers as vegetable, animals and synthetic fibers. Evaluation of fibers in surgical dressings, BPC standards for dressings and sutures. Discussion on cotton, wool, cellulose, rayon, catgut and nylon.

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

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

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

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

Lab Course Outline:-

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters), Microscopic examination of powders and sections of plant drugs. (Note: A minimum of 10 practicals will be conducted). **NOTE:** A Study Tour will be an integral part of the syllabus and will be arranged at the end of the session for collection of medicinal plants from the country.

Recommended Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York 1955-1977.
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers 2000.

3. Ayurvedic Pharmacognosy, Partab Chauhan, Ed., Sonali Publications, New Delhi 2007.
4. Vitamins in Medicine, Vol. 1-2 Baker B.M. and Bender D.A. 1980-82
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York, 2000.
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York 1981.
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart 1994.
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, 200).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester, 1997.
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa, 2003.
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad, 2003.
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London, 2007.
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia 2001.
14. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, 1988.
15. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, 2005.
16. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester, 1999.
17. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol, 1975.
18. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher, 2009.
19. Pharmacognosy, 9th ed., Tyler V.E., Brady E.R. and Robbers J.E. Lea & Febiger, Philadelphia 1988.

PHM213
Pharmaceutics IIIA (Pharmaceutical Microbiology & Immunology)
Course Objectives:-

The objectives of teaching microbiology in Pharmacy are to develop among students the basic understanding the fundamentals of microbiology, including bacteriology, virology, and immunology, along with their clinical and epidemiological applications. After completing this course students will also be able to establish the correlation of disease prediction, progression and treatment to its etiological pathogen.

Theory Course Outline:-

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

2. MICRO-ORGANISMS:

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

ii. The Viruses: Introduction, Classification (and detail of at least one species from every group), cultivation and replication.

iii. The Fungi/Yeast/Moulds:

iv. The Protozoa:

3. THE NORMAL FLORA:

i. Microbiology of air, water and soil (general introduction and normal inhibitants of air, water and soil).

ii. Normal flora of Skin, Intestinal tract, Ear, Nose etc.

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

Lab Course Outline:-

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

Recommended Books:

1. Medical Microbiology and Immunology, 11th edition, Jawetz, Churchill Livingstone, London, 2001.
2. Pharmaceutical Microbiology, W B Hugo & A D Russell, Black Well Science Ltd, London, 7th Ed, 1998.
3. Microbiology, 4th Ed, by lippincott, William & Willkins, USA, 2004.
4. Introduction to Microbiology, 6th Ed., Alcamo, John Bartlett Publishers, 2003.
5. Microbiological Methods, 8th Ed, Collin and Lynes, Vutterworth Heineman, Oxford, 2004.
6. Microbiology: Essentials and Application, M Mekallee, McGraw-Hill Inc, 2nd Ed.
7. Dictionary of Microbiology and Molecular Biology, 3rd Ed, Singleton and Sainsbury, John Willey & Sons, New York, 2006.
8. Microbiology, 5th Ed, Pelczar, McGraw-Hill Inc, 2002.
9. Microbiology, 6th Ed, Prescott, Harley, Klein Wm, C Brown Publishers, 2006.

PHM214
Pharmaceutics IIIB (Pharmaceutical Microbiology & Immunology)

Course Objectives:-

The objectives of teaching microbiology in this Pharm. D. course are to develop among students the understanding of the fundamental concepts of microbiology, including bacteriology, virology, and immunology, along with their clinical and epidemiological applications. After completing this course students will be able to establish the correlation of disease prediction, progression and treatment to its etiological pathogen.

Theory Course Outline:-

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

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

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

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

Laboratory Course Outline:

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

Recommended Books:

1. Medical Microbiology and Immunology, 11th edition, Jawetz, Churchill Livingstone, London, 2001.
2. Pharmaceutical Microbiology, W B Hugo & A D Russell, Black Well Science Ltd, London, 7th Ed, 1998.
3. Microbiology, 4th Ed, by lippincott, William & Willkins, USA, 2004.
4. Introduction to Microbiology, 6th Ed., Alcamo, John Bartlett Publishers, 2003.
5. Microbiological Methods, 8th Ed, Collin and Lynes, Vutterworth Heineman, Oxford, 2004.
6. Microbiology: Essentials and Application, M Mekallee, McGraw-Hill Inc, 2nd Ed.
7. Dictionary of Microbiology and Molecular Biology, 3rd Ed, Singleton and Sainsbury, John Willey & Sons, New York, 2006.
8. Microbiology, 5th Ed, Pelczar, McGraw-Hill Inc, 2002.
9. Microbiology, 6th Ed, Prescott, Harley, Klein Wm, C Brown Publishers, 2006.

PHM118
Pharmacy Practice IB (Biostatistics)
Course Objectives:

This course will develop the basic understanding of statistical approach, among the students, which plays a key role in various aspects of research on drugs. The bioassay in drug development is to measure the potency of some new compounds relative to some standard drugs in terms of the magnitude of their effects. Statistics is used to test as many assumptions involved in the assay. Statistics is also required to design the clinical trials to obtain pharmaceutical information of any drug. The statistical approach is also used to estimate parameters. Statistics also helps in documenting the results of a study. The statistical approach is required for screening of compounds for clinically active drugs. The knowledge of statistics is also required for the study of the dose response relationship.

Course Outline:

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

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

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

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

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

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

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

8. STUDENT "t", "F" and Chi-Square Distributions: Test of Significance based on ―t‖, ―F‖ and Chi-Square distributions.

9. ANALYSIS OF VARIANCE: One-way Classification, Two-way Classification, Partitioning of Sum of Squares and Degrees of Freedom, Multiple Compression Tests such as LSD, The analysis of Variance Models.

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

Recommended Books:

1. A Textbook of Pharmaceutical Mathematics. 2nd Ed. Bali N, Gupta P, Gandhi C. Laxmi Publications; 2008.
2. Calculus and Analytic Geometry. 5th Ed. Edvards CH, Penney DE,.Prentice Hall Inc; 1999.
3. Introduction to Statistical Theory. 1st Ed. Hoel PG, Port SC, Stone CJ,.Brooks Cole; 1972.

PHM301
Pathology
Course Objectives:-

The contents included in this course of pathology will enable the students to understand different diseases and the conditions, physiological variations, and hormonal changes. Understanding of pathology in this course will help the students to distinguish abnormal and normal body function.

Theory Course Outline:-

1. SCOPE OF PATHOLOGY & CONCEPT OF DISEASES:

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

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

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

Lab Course Outline:-

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

2. EXAMINATION OF DIFFERENT BODY FLUIDS IN VARIOUS PATHOLOGICAL CONDITIONS:
Urine Complete Examination, Stool Examination, Blood Complete Examination, Semen Examination, Cerebrospinal Fluid Examination, Pericardial Fluid Examination, Pleural Fluid Examination, Ascitic Fluid Examination, Blood Sugar, Blood Urea, Blood Cholesterol etc.

3. TESTS FOR VARIOUS SPECIMENS OF CLINICAL IMPORTANCE:
Techniques of Clinical Blood Examination for various disases, Gastric Analysis, Tests for liver function, Renal function test, Tests for endocrine abnormalities, Biopsies and cytologic techniques.

Recommended Books:
1. Basic Pathology, 6th edition, Kumar Cotran Robbins, W B Saunders Company, Philadelphia, 2000.
2. General Pathology, 7th Ed, Walters and Israel, Churchill Livingstone, London, 1998.
3. Pathology Illustrated, 5th Ed, Peter S Macfarlane, Robin Reid, Robin Collander, Churchill Livingstone, London, 2000.
4. Robbins Pathology, 7th Ed., W B Saunders Co, London, 2002.
5. General Pathology, Walter G B, Churchill Livingstone, New York, 1996

PHM302
Pharmacy Practice III (Computer and its Applications in Pharmacy)
Course Objectives:-

This course has been designed, specifically for Pharm-D students with the objective of introducing them with computer. The students will be able to learn basic introduction of computer with special reference to its applications in pharmacy.

Theory Course Outline:-

1. FUNDAMENTALS OF COMPUTERS:

i. History of Data Processing

ii. Types of Computers

iii. Components of a Computer

iv. Computer System and Business Computer System

v. Backing Storage Devices

vi. Unit of Memory

vii. Viruses and Anti-viruses Issues

2. RESEARCH METHODOLOGIES:

3. SYSTEM ANALYSIS AND DESIGN:

i. What is a System?
ii. Steps in system life cycle
iii. Data Gathering and Data Analysis
iv. Designing a New System
v. Development and Implementation of New System
vi. Documentation.

4. DATA PROCESSING:

i. Data Processing
ii. The Data Processing Cycle
iii. The Collection and Computing of data
iv. Manual collection of data
v. The main methods of data input
vi. Devices used to collect data
vii. Data Verification
viii. Data Validation
ix. Output and Recording of data
x. Types of data processing systems
xi. Types of Computer Operation
xii. Batch Processing and Real-time Processing

5. APPLICATION OF COMPUTERS IN HOSPITAL PHARMACY:

i. Patterns of Computer use in Hospital Pharmacy
ii. Patient record database management
iii. Medication order entry
iv. Drug labels and list
v. Intravenous solution and admixture
vi. Patient Medication profiles
vii. Inventory control
viii. Management report & Statistics

6. APPLICATION OF COMPUTER IN COMMUNITY PHARMACY:

i. Computerizing the Prescription Dispensing process,
ii. Use of Computers for Pharmaceutical Care in community pharmacy,
iii. Accounting and General ledger system.

7. APPLICATION OF DRUG INFORMATION RETRIEVAL & STORAGE:

i. Introduction
ii. Advantages of Computerized Literature
iii. Retrieval use of Computerized Retrieval

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

Lab Course Outline: -

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

2. **WEB PAGE DEVELOPMENT**: Introduction to Front-page, Creating a First Web site, Basic Formatting Techniques, Manipulating Tables within Front-page, Front-page, Picture and MultiMedia, Hyper linking, Bookmarks and Image Maps, Introducing Front-page ―components‖, Front-page and Frames, Managing your Web, Good site design, Publishing and publicizing.

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

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

Recommended Books:

1. Elias M System Analysis. Award Galgotia Publications, New Delhi.
2. Peter Norton, Inside IBM PC. Brady Computer Books, New York.
3. Dennis N, MS-DOS. Jump Practice Hall Press, New York.
4. Peter Norton, PC-DOS, Brady Computer Books, New York.

PHM305
Pharmacology and Therapeutics IIA
Course Objectives:-

This course will help the students to understand the pharmacology of different classes of drugs acting on Central Nervous System and will they will also be taught about Pharmacology of anesthetic drugs, ranging from examining the effects of these drug agents on subcellular mechanisms, to those that deal the treatment and prevention of diseases with drug therapy and with the potential hazards of toxic substances. After the completion of this course students will have the knowledge of the sources, chemical properties, biological effects and therapeutic uses of these drugs.

Theory Course Outline:-

1. DRUGS ACTING ON CENTRAL NERVOUS SYSTEM:

i. Sedatives & Hypnotic

ii. Anxiolytics, antidepressants and antimanic drugs

iii. Antiepileptics

iv. Antiparkinsonian and drug used in other neurodegenerative diseases.

v. Antipsychotics

vi. Opioid analgesics

vii. Therapeutic gases (Oxygen, Carbon-dioxide, Nitric oxide and Helium.

viii. Cerebral Stimulants, Medullary stimulants, Spinal Cord Stimulants.

ix. Anesthetics: General and local

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

Lab Course Outline:-

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

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

Note: A minimum of 10 practicals should be conducted)

Recommended Books:

1. Pharmacological basis of Therapeutics. 11th Ed, Goodman Gilman, McGraw-Hill Book Company, New York, 2008.

2. Human Pharmacology, Winguard and Brody's, Mosby Year Book, Boston, 1991.

3. A Text book of Clinical Pharmacology, 5th Ed James M Ritter and Lionel De Levis, Oxford University Press, New York, 2008.

4 Pharmacology and Pharmacotherapeutics, 19th Ed, . R S Satorkar and S D Bhandarkar, Popular Prakashan, Bomby, 1998.

5. Essential of Medical Pharmacology, J D Tripathy, Japees Brother, New Delhi, 6th Ed., 2008.

6. Clinical Pharmacology, D R Laurence, ELBS, London, 8th Ed., 1998.

7. Basic and Clinical Pharmacology, Katzung B G, McGraw-Hill Medical Publishers, New York, 11th Ed., 2009.

8. Pharmacology, 4th Ed, Lippincott, Lippincott William & Wilkins, USA, 2008.

9. Pharmacology, Manuchair Ebadi, Little Brown & Company, London, 1993

10. Basic and Clinical Pharmacology, Bertram G K, Paramount Publishing Business & Professional Group, USA, 10th Ed., 2007.

11. Review of Medical physiology, 22nd Ed, William F Ganong, W F, Prentice Hall International Inc, New Jersey, 2005

12. Fundamentals of Experimental Pharmacology. Qayum A, Ghandhara University, Peshawar, 2004.
13. Pharmacology, 6th Ed, Humphrey P. Rang, Rang & Dale's, 2007.

PHM306
Pharmacology and Therapeutics IIB
Course Objectives:-

The objective of this course is to teach the students about Pharmacology of different classes of drugs related with chemotherapy. The students will also learn about hormones, antagonists and other agents affecting endocrine functions. Toxicology of different classes of compounds will also be taught to them and after completing this course they will be able to develop better understanding of the pharmacology of drugs and drug compounds.

Theory Course Outline:-

1. CHEMOTHERAPY:

i. Basic principles of chemotherapy.

ii. Antibacterials: (Folate antagonists; sulphonamides. Cell wall synthesis inhibitors; Penicillin, Cephalosporins, Carbapenam, Monobactam. Protein synthesis inhibitors; Aminoglycosides, Tetracyclines, Chloramphenicol, Macrolides. Nucleic acid synthesis inhibitors; Quinolones and miscellaneous Antibiotics), Antimycobacterial drugs, Urinary tract antiseptics.

iii. Anti-fungals:

iv. Anti-virals:

v. Anti-protozoals: (anti-malarias, anti-amebiasis, anthelmintics and anti- leishmanials).

vi. Anti-neoplastic drugs:

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

3. TOXICOLOGY:

i. Pollution and its types (water, air, food)

ii. Poison and principle of treatment of poisoning.

iii. Poisoning (Sign & symptom and treatment): Ethanol, Barbiturates, Digitalis, Salicylates, Strychnine, Narcotics, Nicotine, Paracetamol, Benzodiazepines and organophosphorous compounds.

iv. Chelating agents and their role in poisoning: Dimercaprol, Calcium disodium edentate (Calcium EDTA), Pencillamine and Defroxamine.

NOTE:

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

Lab Course Outline: -

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

1. To study the convulsant effects of strychnine and picrotoxin in frogs and to determine the site of action.
2. To identify the unknown (convulsant) drug and determine its site of action.

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

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

Recommended Books:

1. Pharmacological basis of Therapeutics. 11th Ed, Goodman Gilman, McGraw-Hill Book Company, New York, 2008.

2. Human Pharmacology, Winguard and Brody's, Mosby Year Book, Boston, 1991.

3. A Text book of Clinical Pharmacology, 5th Ed James M Ritter and Lionel De Levis, Oxford University Press, New York, 2008.

4 Pharmacology and Pharmacotherapeutics, 19th Ed, . R S Satorkar and S D Bhandarkar, Popular Prakashan, Bomby, 1998.

5. Essential of Medical Pharmacology, J D Tripathy, Japees Brother, New Delhi, 6th Ed., 2008.

6. Clinical Pharmacology, D R Laurence, ELBS, London, 8th Ed., 1998.

7. Basic and Clinical Pharmacology, Katzung B G, McGraw-Hill Medical Publishers, New York, 11th Ed., 2009.

8. Pharmacology, 4th Ed, Lippincott, Lippincott William & Wilkins, USA, 2008.

9. Pharmacology, Manuchair Ebadi, Little Brown & Company, London, 1993

10. Basic and Clinical Pharmacology, Bertram G K, Paramount Publishing Business & Professional Group, USA, 10th Ed., 2007.

11. Review of Medical physiology, 22nd Ed, William F Ganong, W F, Prentice Hall International Inc, New Jersey, 2005

12. Fundamentals of Experimental Pharmacology. Qayum A, Ghandhara University, Peshawar, 2004.

13. Pharmacology, 6th Ed, Humphrey P. Rang, Rang & Dale's, 2007.

PHM309

Pharmacognosy IIA (Advanced)
Course Objectives:-

The aim of teaching this course of Pharmacognosy is to make students understand the concept of medicinal plants in modern system of medicine and overall view of uses of these plants constituents like alkaloids, glycosides, saponins, flavonoides, tannins, fixed oils, volatile oils, etc. Different separation and isolation techniques of these chemicals are also aimed.

Theory Course Outline:-

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

2. CARBOHYDRATES AND RELATED COMPOUNDS: Introduction and classification of carbohydrates, sugars as adjuvant in drugs, role of impurities in sugar substances.
i. Sucrose and Sucrose containing drugs: Sucrose, Dextrose, Liquid glucose, Fructose, Lactose, Xylose, Caramel, Starch, Inulin, Dextrine etc.

ii. Cellulose and Cellulose Derivatives: Powdered cellulose, Microcrystalline cellulose, Methyl cellulose, Sodium Carboxy-methyl cellulose.

iii. Gums and Mucilage: Tragacanth, Acacia, Sodium Alginate, Agar, Pectin.

3. ALKALOIDS: Introduction, Properties, Cassification, Function of alkaloids in plants, Methods of extraction and identification tests.
i. Pyridine-Piperidine Alkaloids: Areca nut, Lobelia.

ii. Tropane Alkaloids: Belladonna, Hyoscyamus, Stramonium.

iii. Quinoline Alkaloids: Cinchona.

iv. Isoquinoline Alkaloids: Ipecacuanha, Opium.

v. Indole alkaloids: Rauwolfia, Catharanthus, Nux vomica, Physostigma, Ergot.

vi. Imidazole alkaloids: Pilocarpus.

vii. Steroidal alkaloids: Veratrum.

viii. Alkaloidal amines: Ephedra, Colchicum.

ix. Purine Bases: Tea, Coffee.

4. GLYCOSIDES: Introduction, classification, chemistry, extraction, isolation and medicinal uses of:
i. Cardioactive glycosides: Digitalis, Strophanthus and White squill.

ii. Anthraquinone glycosides: Cascara, Aloe, Rhubarb, Cochineal & Senna.

iii. Saponin glycosides: Glycyrrhiza, Sarsaparilla.

iv. Cyanophore glycosides: Wild cherry.

v. Isothiocyanate glycosides: Black mustard.

vi. Lactone glycosides: Cantharide.

vii. Aldehyde glycosides: Vanilla.

viii. Miscellaneous glycosides: Gentian, Quassia, Dioscorea.

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

6. LIPIDS: Introduction, classification, source, active constituents and pharmacological uses of:

i. Fixed Oils: Castor oil, cotton seed oil, olive oil, peanut oil, sun flower oil, corn oil, coconut oil, almond oil, linseed oil, mustard oil, sesame oil and soybean oil.

ii. Fats and Related Compounds: Theobroma oil and Lanolin.

iii. Waxes: Bees wax, carnauba wax, spermaceti and Jojoba oil.

Lab Course Outline:-

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

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

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

Recommended Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York 1955-1977.
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers 2000.
3. Ayurvedic Pharmacognosy, Partab Chauhan, Ed., Sonali Publications, New Delhi 2007.
4. Vitamins in Medicine, Vol. 1-2 Baker B.M. and Bender D.A. 1980-82
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York, 2000.
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York 1981.
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart 1994.
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, 200).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester, 1997.
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa, 2003.
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad, 2003.
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London, 2007.
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia 2001.
14. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, 1988.
15. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, 2005.
16. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester, 1999.
17. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol, 1975.

18. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher, 2009.
19. Pharmacognosy, 9th ed., Tyler V.E., Brady E.R. and Robbers J.E. Lea & Febiger, Philadelphia 1988.

PHM310
Pharmacognosy IIB (Advanced)
Course Objectives:

The teaching of this Pharmacognosy course to Pharm. D. students is aimed at different aspects of crude drugs, their cultivation, identification, collection, evaluation and other processes from plants. The study also includes the different classes of chemicals (constituents) and their uses present in the crude drugs like, alkaloids, glycosides, saponins, flavonoids, tannins, fixed oil, volatile oil, hormones, pesticides enzymes etc. Different separation techniques e.g., chromatography including column, tlc, hplc, ion exchange, electrophoresis for the isolation of bioactive chemicals are also discussed in this subject. The student will be able to know the different systems of medicines e.g., unani, phyto-pharmacology, traditional medicine and alternative system of medicine.

Theory Course Outline:

1. VOLATILE OILS (ESSENTIAL OILS): Introduction, significance, sources, active constituents, methods of obtaining volatile oils, chemistry and classification of:
i. Hydrocarbon volatile oils: Cubeb and Turpentine oil.

ii. Alcoholic volatile oils: Peppermint, Coriander and Cardamom.

iii. Aldehydic volatile oils: Bitter orange peel, sweet orange peel, Lemon, cinnamon and bitter almond oil

iv. Ketonic volatile oils: Camphor, spearmint, caraway, Buchu

v. Phenolic volatile oils: Clove, Thyme.

vi. Phenolic ether volatile oils: Fennel, Anise, Myristica.
vii. Oxide volatile oils: Eucalyptus, chenopodium.
viii. Ester volatile oils: Rosemary.

ix. Miscellaneous volatile oils: Allium, Anethum.

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

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

4. NATURALTOXICANTS:
i. General Introduction to Plant Toxicology: Definition, classification and chemical nature of plant toxins. Plant toxicities in humans and animals

ii. Higher Plant Toxins: Essential oils: Terpene (cineol, pine oil), Phenyl propane (apiol, safrole, myristicin), Monoterpene (thujone, menthafuran) Plant acids (oxalic acid, amino acid, resin acid), Glycosides (cardiotonic, cyanognic), Alkaloids (imidazole, pyrrolizidine, tropane).

iii. Lower Plant Toxins: Bacterial toxins (Staphylococcus aureus, Clostridium botulinum), Algal toxins (Microcystis aeruginosa, Cyanobecteria, Gonyaulax cantenella).

iv. Mycotoxins: Fungal toxins (Aspergillus spp., Claviceps purpurea), Mushrooms (Amanita spp.).

v. Study of Toxins, their Prevention and Control Methods: Description, pharmacognostic features, pharmacological actions, chemical constituents, treatment, side-effects, contra-indications, warnings, prevention and control methods of Abrus precatorius, Papaver somniferum, Eucalyptus spp., Nicotiana tabaccum, Cannabis sativa, Digitalis purpurea, Datura stramonium poisoning.

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

6. **TUMOR INHIBITORS FROM PLANTS:** Introduction of anticancer agents of natural origin, as Catharanthusroseus, Colchicum autumnale, Podophyllum peltatum, rifamycin antibiotics, macrolide antibiotics, anti-AIDS agents and immunostimulants.

7. **INTRODUCTION TO CLINICAL PHARMACOGNOSY:** General introduction and historical background of clinical Pharmacognosy. Study of treatment by herbal medicines

8. **CLINICAL USE OF HERBS & HERBAL MEDICINE:**

Diabetes: *Gymnema sylvestre, Melia azadirchta, Momordicacharantia, Syzygium jambulana.* Cardiac diseases: *Digitalis spp., Convallaria majalis, Urgenia indica, Allium sativum, Punica granatum.* Hepatitis: *Berberis vulgaris, Picrorhiza kurroa, Lawsonia innermis.*
Respiratory diseases: *Ficus religosa, Adhatoda vasica.*

Skin diseases: *Aloe vera, Angelica archangelica, Mentha piperita, Citrus spp., Commiphora mukul.*

CNS disorders: *Strychnos nux-vomica, Datura stramonium, Cannabis sativa, Papaver somniferum, Atropa belladonna.*

Musculo-skeletal disorders:*Nigella sativa, Phycotis ajowan, Trigonella foenum-graecum, Zingiber officinale.*
Renal disorders: *Cucumis melo, Berberis vulgaris, Zea mays, Tribulus terrestris.*

Reproductive disorders: *Saraca indica, Ruta graveolens, Nigella sativa, Glycyrrhiza glabra, Claviceps purpurea, Myristica fragrance.*

G.I.T. disorders: *Foeniculum vulgare, Ferula foetida, Cuminum cyminum, Aegle marmelos, Prunus domestica.*

Lab Course Outline:-

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

Also include the following experiments:

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

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

Recommended Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York 1955-1977.
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers 2000.
3. Ayurvedic Pharmacognosy, Partab Chauhan, Ed., Sonali Publications, New Delhi 2007.
4. Vitamins in Medicine, Vol. 1-2 Baker B.M. and Bender D.A. 1980-82
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York, 2000.

6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York 1981.
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart 1994.
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, 200).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester, 1997.
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa, 2003.
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad, 2003.
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London, 2007.
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia 2001.
14. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, 1988.
15. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, 2005.
16. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester, 1999.
17. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol, 1975.
18. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher, 2009.
19. Pharmacognosy, 9th ed., Tyler V.E., Brady E.R. and Robbers J.E. Lea & Febiger, Philadelphia 1988.

PHM313
Pharmaceutical Chemistry IIIA (Pharmaceutical Analysis)
Course Objectives:

The basic objective of this course is to give knowledge to the Pharm. D. students about different analytical techniques used for the qualitative and quantitative analysis of drugs and drug compounds. Students will be given the basic knowledge regarding the theory, instrumentation and pharmaceutical applications of each technique with special reference to pharmaceutically important compounds. After completing this course students will be able to perform the assays of drugs by using modern instrumental techniques and will also be able to identify the unknown Pharmaceutical compounds. This course will help the students for their future work in drug design and drug evaluation studies.

Theory Course Outline:

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

1. SPECTROSCOPIC METHODS: Theory, Instrumentation and Pharmaceutical Applications of the following Spectroscopic Methods:
i. Atomic Absorption and Emission Spectroscopy
ii. Molecular Fluorescence Spectroscopy
iii. Flame Photometry
iv. I.R. Spectroscopy
v. Mass Spectroscopy

vi. NMR Spectroscopy

vii. U.V./Visible Spectroscopy

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

Laboratory Course Outline:-

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

Recommended Books:

1. High Performance Liquid Chromatography, Lough W J, Blacki Academic Press, New York, 1996.
2. Organic Spectroscopy, 3rd Ed, William Kemp, Ellsi Horwood, London, 2008.
3. Theory and Practice of Chromatography, M Aminuddin & Javed Iqbal, 2000.
4. Practical Pharmaceutical Chemistry, 4th Ed, Part I and II, A H Beckett and J B Stennlake, the Aulton Press, London. 2001.
5. Jenkin‘s quantitative Pharmaceutical Chemistry, 7th Ed, A M Knevel and F E Digangi, McGraw-Hill Book company, New York.1977.
6. Chromatographic Methods, 5th Ed, A Braithwaite and F J Smith, Chapman and Hall, London. 1995.
7. Chromatography, 6th Ed, E Heftmann, Von Nostrond Reinheld Co, New York, 2004.
8. Applications of High Performance Liquid Chromatography, A Pryde and M J Gilbert, Chapman & Hall, London, 1979.
9. Thin Layer Chromatography, 2nd Ed, E Stahl, Springer-Verlag, Berlin, 1969.
10. Introduction to HPLC, R Hamilton, P A Sewell, Chapman & Hall, London, 1982.

PHM314
Pharmaceutical Chemistry IIIB (Pharmaceutical Analysis)
Course Objectives:-

The basic objective of this course is to give knowledge to the Pharm. D. students about different modern analytical techniques used for the separation, identification and analysis of drugs and drug compounds. In this course students will also learn about electro-analytical methods for analysis of drugs and differential scanning calorimetry. After completing this course students will be able to purify, separate and identify the components of a mixture. They will also learn the analysis of drugs by using latest instrumental and electro-analytical techniques.

Theory Course Outline:

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

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

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

Lab Course Outline:

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

Recommended Books:

1 High Performance Liquid Chromatography, Lough W J, Blacki Academic Press, New York, 1996.
2. Organic Spectroscopy, 3rd Ed, William Kemp, Ellsi Horwood, London, 2008.
3. Theory and Practice of Chromatography, M Aminuddin & Javed Iqbal, 2000.
4. Practical Pharmaceutical Chemistry, 4th Ed, Part I and II, A H Beckett and J B Stennlake, the Aulton Press, London. 2001.
5. Jenkin's quantitative Pharmaceutical Chemistry, 7th Ed, A M Knevel and F E Digangi, McGraw-Hill Book company, New York.1977.
6. Chromatographic Methods, 5th Ed, A Braithwaite and F J Smith, Chapman and Hall, London. 1995.
7. Chromatography, 6th Ed, E Heftmann, Von Nostrond Reinheld Co, New York, 2004.
8. Applications of High Performance Liquid Chromatography, A Pryde and M J Gilbert, Chapman & Hall, London, 1979.
9. Thin Layer Chromatography, 2nd Ed, E Stahl, Springer-Verlag, Berlin, 1969.
10. Introduction to HPLC, R Hamilton, P A Sewell, Chapman & Hall, London, 1982.

PHM317
Pharmacy Practice IIA (Dispensing Pharmacy)
Course Objectives:-

The topics included in this course of Dispensing are essential for a pharmacist to know while working in a pharmacy as how to prepare and supply medicines. This course provides the knowledge of stability of medicines and their ingredients, principle of compounding, dosage, chemical, physical and therapeutic incompatibility, packaging methods, labeling procedures, legal requirements affecting drug storage, supply and records, containers and labeling of substances and misuse of drugs.

Theory Course Outline:-

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

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

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

Lab Course Outline:-

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Practical introduction to prescription handling, interpretation, filling and labeling.
Mixtures: Dispensing of simple mixtures containing soluble substances only, mixtures containing diffusible substances, in-diffusible substances and mixtures forming precipitate.
Powders: Dispensing of simple powders, compound powders and effervescent powders for external use.
Incompatibility: Practical importance of Incompatibilities**.**
Ointments and Creams: Dispensing of iodine and Methyl salicylate ointment. Dispensing of cold cream and vanishing creams.
Cosmetics: Lipstick, talcum powder, after shave lotion, shaving cream.
Note: A minimum of 20 practicals will be conducted).
Health Science Research Project: In the area of health care system, community pharmacy. Establishment of DIC, PCC.

Recommended Books:
1. Dispensing, Cooper and Guns, CBS Publishers & Distributors, New Delhi, 1986.
2. Cooper and Gunn's dispensing for pharmaceutical students, J. W. Cooper, Colin Gunn, S. J. Carter, Churchill Livingstone, 1987
3. Pharmaceutical compounding and dispensing, John F. Marriott, Pharmaceutical Press, 2006.

PHM318
Pharmacy Practice IIB (Community, Social & Administrative Pharmacy)
Course Objectives:-

The subject will be taught to Pharm. D. students for giving the basic knowledge of different definitions and background of community pharmacy, importance of communication with patients, imparting knowledge about different methods used to control drug abuse and misuse and for identifying the role of pharmacist as public health educator in the community for drug monitoring and information.

Course Outline:-

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

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

4. PATIENT EDUCATION AND COUNSELLING:

5. CONTROL OF DRUG ABUSE AND MISUSE:

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

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

8. PHARMACOECONOMICS: Pharmacoeconomic modeling & interpretation.

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

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

Recommended Books:

1. Management of Drug Users in the Community: A practical Handbook, Roy Robertson, 1998.
2. Remington‘s Pharmaceutical Sciences, Mack Publishing Company, USA, 2001
3. Martindale's Extra Pharmacopeia, 2009.
4. Promoting treatment adherence: a practical handbook for health care providers; William T. O'Donohue, Eric R. Levensky, Sage Publications, 2006
5. Pharmacy management: essentials for all practice settings - Shane P. Desselle, David P. Zgarrick, McGraw-Hill Professional, 2004.
6. International pharmaceutical services: Richard N. Spivey, Albert I. Wertheimer, T. Donald Rucker, Routledge, 1992

PHM401
Pharmacy Practice IVA (Hospital Pharmacy)
Course Objectives:-

The topics included in this course cover different aspects of hospital pharmacy. This course will help the students to understand how a pharmacy fits into the total hospital set-up, about the role of hospital pharmacist, about the pharmacy staff, the standards of practice, and distributive portions of the pharmacy. By completing this course students will also be able to learn some of the clinical and management aspects of hospital pharmacy and role of pharmacist out of hospital setups.

Course Outline:-

1. INTRODUCTION:

i. Role of Pharmacist in Hospital

ii. Minimum standards for pharmacies in Institutions/Hospitals

iii. Research in Hospital Pharmacy

2. HOSPITAL AND ITS ORGANIZATION:

i. Classification of Hospitals
ii. Organizational Pattern
iii. Administration
iv. Clinical Departments
v. Nursing, Dietetic, Pathology, Blood Bank, Radiology and other supportive services
vi. Role of Pharmacy in Hospital
vii. Hospital Finances

3. PHARMACY, ITS ORGANIZATION AND PERSONNEL:

i. Pharmacy specialist
ii. Drug information Centre
iii. Poison Control Centre and Antidote Bank
iv. Pharmacy Education
v. Determining the Need of Professional and other departmental staff
vi. Professional services rendered

4. PHARMACY AND THERAPEUTIC COMMITTEE:

5. THE HOSPITAL FORMULARY:

i. General Principles and guidelines to develop Formulary
ii. Format
iii. Preparation of the Formulary
iv. Role of Pharmacist
v. Benefits and problems
vi. Keeping up to date Formulary

6. DISPENSING TO INPATIENTS:

i. Methods of Dispensing & SOP's
ii. Unit dose dispensing
iii. Other concepts of dispensing, Satellite Pharmacy etc.

7. DISPENSING TO AMBULATORY PATIENTS:

8. DISTRIBUTION OF CONTROL SUBSTANCES:

9. DISPENSING DURING OFF-HOURS:

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

Recommended Books:

1. Hospital Pharmacy, William Hassan, Lee & Febiger, Washington, 5th Ed., 1986.
2. Hospital Pharmacy, N I Bukhari, Aziz Book Depot, Lahore-Pakistan 2000.

3. Hospital Pharmacy, Martin Stephen, Pharmaceutical Press, London, 2003.

PHM402
Pharmacy Practice IVB (Hospital Pharmacy)
Course Objectives:-

The objectives of this course are to give students understanding about different aspects of hospital pharmacy. The students will be able to gain knowledge about manufacturing of bulk and sterile dosage forms, sterile storage room, aseptic dispensing, their role in small hospitals and in purchase of medicines in hospitals and many other aspects and duties of hospital pharmacist. By completing this course students will be able to understand, among others, some of the clinical and management aspects of hospital pharmacy.

Course Outline:-

1. MANUFACTURING BULK AND STERILE:

2. THE PHARMACY; CENTRAL STERILE SUPPLY ROOM:

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

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

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

6. NUCLEAR PHARMACY:

7. THE PHYSICAL PLANT AND ITS EQUIPMENT:

8. INVESTIGATIONAL USE OF DRUGS:

9. HEALTH ACCESSORIES:

10. SURGICAL SUPPLIES:

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

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

Recommended Books:
1. Hospital Pharmacy, William Hassan, Lee & Febiger, Washington, 5th Ed., 1986.
2. Hospital Pharmacy, N I Bukhari, Aziz Book Depot, Lahore-Pakistan 2000.
3. Hospital Pharmacy, Martin Stephen, Pharmaceutical Press, London, 2003.

PHM403
Pharmacy Practice VA (Clinical Pharmacy)
Course Objectives:-

The objectives of this course are to develop, among students, the practice of pharmacy in clinical setting especially

in a hospital. The concept of clinical pharmacy and the role that the pharmacists are playing internationally will be introduced. By Studying this course will help students to develop understanding of therapeutic drug monitoring, determining toxicities, drug interactions, adverse drug reactions and dosage regimen establishment. It will help them in proper selection of drugs, administration route, as well as guiding patients about the drug therapy. The students will also learn the concept of rational use of drugs, essential drugs and their advantages, drug utilization evaluation and review, practical pharmacokinetics and the role of pharmacist in pharmaceutical care, its scope, management and application.

Theory Course Outline:-

1. GENERAL INTRODUCTION TO CLINICAL PHARMACY:

i. Introduction to clinical pharmacy and related terms, definition, basic components, comparison with other clinical fields, scope of services.
ii. General guidelines for clinical pharmacy practice.
iii. Patient Counseling Compliance
iv. Laboratory Data interpretation
v. Electrolytes management
vi. Clinical literature evaluation
vii. Drug interactions
viii. Medication errors

2. PATIENT PROFILE & PATIENT COUNSELING:

i. Patient disease profile

ii. Taking case history

iii. Drug Profile of at least 25 Important Medications e.g. Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cepahlosporins, Chlorpheniramine, Cimetidine, Digoxin, Dobutamine, Dopamine, Fluroquinolone, Frusemide, Lactulose, Macrolides, Metoclopramide, Morphine/Pethedine, Nifedipine, NSAIDS, ORS, Penicillins, Prednisolone, Salbutamol, Vancomycin.

iv. Patient Counseling.

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

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

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

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

Lab Course Outline:-

1. Clerkship in the Clinical Setting. A report Related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.
2. Students will also complete a report independently or in a group on a Drug Use Evaluation**.**

3. Students will take the assignment tasks to enhance verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects.

Recommended Books:

1. Clinical Pharmacy & Therapeutics, Roger Walker, Churchill Levingstone, London, 4th Ed., 2003.
2. A Behavioral Approach to Pharmacy Practice, Guard Paul, Black Well, USA, 2000.
3. Clinical Pharmacy & Therapeutics, 4th Ed, Herfindal Gourley, William & Willkins, London, 1992.
4. Pharmaceutical Practice, A J Winfield, Churchill Levingstone, London, 3rd Ed., 1998.
5. Pharmacy Practice, 2nd Ed, Kavin Taylor, Taylor & Francis, New York, 1998.
6. Clinical Research Coordinator Hand Book, 4th Ed., Deborah Rosenbaun, Sarrison, Inc, North Carolina, USA. 2001.
7. Clinical Studies Management, a Practical Guide to Success, Simon Cook, Sue Horwood Publishing limited, and West Sussex UK. 2004.
8. Encyclopedia of Clinical Pharmacy. Joseph T Dipiro, Marcel Dekker Publishing, 2003.
9. Pharmacist Talking with Patients, 2nd Ed, Mellainie J Rantucci, 2006.
10. Oxford Text Book of Clinical Pharmacology and Drug Therapy, Smith GDG and Aronson J K, Oxford University Press, UK, 2002.
11. Drug interactions. Hansten P and Horn J, Lee & Febiger, Philadelphia,USA, 1989.

PHM404
Pharmacy Practice VB (Clinical Pharmacy)
Course Objectives:-

The objective of this course of clinical pharmacy is to teach students about the practice of pharmacy in clinical setting especially in a hospital. After completing this course, students will be able to understand the concepts of drug interactions, adverse drug reactions, drug induced diseases, dosage regimen establishment and utilization of clinical drugs literature. This course will help them for proper selection of drugs, administration route, as well as guiding patients about the drug therapy.

Theory Course Outline:-

1. PHARMACOTHERAPY PLAN:

i. Developing, Implementing and Monitoring Drug Therapy Plans:
a. Pharmacist work up of drug therapy (PWDT)

b.Documentation of Pharmacotherapy Plan, SOAP note, CORE Pharmacotherapy Plan, PRIME Pharmacotherapy problems, FARM note
c. Implementation of Drug Therapy Plan

d. Monitoring of Pharmacotherapeutic plan

e. Pharmaceutical care plan as ongoing process

f. Importance of drug therapy plan in today's pharmacy practice.
ii. Pharmacotherapy Decision-Making:
a. Pursue the role of drug therapy practitioner over that of drug therapy advisor.

b Participate in pharmacotherapy decision-making by: Identifying opportunities for decision-making, Proactively engaging decision-making opportunities, Formulating decision rationale that is the result of rigorous inquiry, scientific reasoning, and evidence, Pursuing the highest levels of decision-making, Seeking independence in making decisions and accepting personal responsibility for the outcomes to patients resulting from one's decisions, Personally enacting decisions.

2. DRUG INDUCED DISEASES:

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

4. ON LINE PHARMACEUTICAL CARE SERVICES AND GLOBALIZATION:

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

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

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

Lab Course Outline:-

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

Recommended Books

1. Clinical Pharmacy & Therapeutics, Roger Walker, Churchill Levingstone, London, 4th Ed., 2003.
2. A Behavioral Approach to Pharmacy Practice, Guard Paul, Black Well, USA, 2000.
3. Clinical Pharmacy & Therapeutics, 4th Ed, Herfindal Gourley, William & Willkins, London, 1992.
4. Pharmaceutical Practice, A J Winfield, Churchill Levingstone, London, 3rd Ed., 1998.
5. Pharmacy Practice, 2nd Ed, Kavin Taylor, Taylor & Francis, New York, 1998.
6. Clinical Research Coordinator Hand Book, 4th Ed., Deborah Rosenbaun, Sarrison, Inc, North Carolina, USA. 2001.
7. Clinical Studies Management, a Practical Guide to Success, Simon Cook, Sue Horwood Publishing limited, and West Sussex UK. 2004.
8. Encyclopedia of Clinical Pharmacy. Joseph T Dipiro, Marcel Dekker Publishing, 2003.
9. Pharmacist Talking with Patients, 2nd Ed, Mellainie J Rantucci, 2006.
10. Oxford Text Book of Clinical Pharmacology and Drug Therapy, Smith GDG and Aronson J K, Oxford University Press, UK, 2002.
11. Drug interactions. Hansten P and Horn J, Lee & Febiger, Philadelphia,USA, 1989.

PHM407
Pharmaceutics IVA (Industrial Pharmacy)
Course Objectives:-

The objectives of this course are to teach Pharm. D. students different techniques being used in Pharmaceutical Industry. After studying this course, the students will become able to understand the manufacturing of different dosage forms at large scale. The understanding of techniques for preparation of these dosage forms, latest advances in product formulation, techniques and technology for their production will help the students in future to work in Pharmaceutical Industry as a Pharmacist.

Theory Course Outline:-

1. MASS TRANSFER:

2. HEAT TRANSFER:

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

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

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

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

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

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

Lab Course Outline:

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

Recommended Books:

1. Theory and Practice of Industrial Pharmacy, 3rd Ed, Lachman, Verghese Publishing House, Bombay, 2009.
2. Cooper and Gunn‘s, Tutorial Pharmacy, 6th Ed, CBS Publishers & Distributors, New Delhi, 2004.
3. Bentley‘s Pharmaceutical Text Book, CBS Publishers & Distributors, New Delhi, 1986.
4. Remington‘s Pharmaceutical Sciences, 21st Ed, Mack Publishing Company, USA, 2005.
5. Good Pharmaceutical Manufacturing Practice, 6th Ed, John Sharp, Rational and Compliance. 2009.

PHM408

Pharmaceutics IVB (Industrial Pharmacy)
Course Objectives:-

This course will give the students understanding about different equipments and techniques used in the industry for the formulation of different drug dosage forms. After completion of this course students will also be able to understand the standardization of pharmaceuticals and their packing together with GMP of pharmaceutical industries.

Theory Course Outline:-

1. EMULSIONS: Mechanical Equipments, Specific formulation consideration and Emulsion stability.

2. SUSPENSIONS: Formulation of suspensions, Equipment used in preparation and test methods for pharmaceutical suspensions.

3. SEMISOLIDS: Equipment used for Ointments, Pastes, Gels and Jellies. Packaging of ointments.

4. STERILE PRODUCTS: Sterile area and its Classification, Ophthalmic ointments, Preparation of parenterals (Building, Equipment), Complete Sterility (Aseptic area), air control, (Laminar flow etc.), air locks, Environmental monitoring methods, Sterilization, Filling/Packaging (Plastic and glass containers), Added substances (Preservatives, anti-oxidants, solubilizer, suspending agents, buffers, stabilizers etc.), Inprocess Quality Control of Parenterals (Sterility, leakage, pyrogens, clarity etc.).

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

6. SAFETY METHODS IN PHARMACEUTICAL INDUSTRY:

i. Mechanical, chemical and fire hazards problems.

ii. Inflammable gases and dusts.

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

Lab Course Outline:-

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

Recommended Books:

1 Theory and Practice of Industrial Pharmacy, 3rd Ed, Lachman, Verghese Publishing House, Bombay, 2009.
2. Cooper and Gunn‘s, Tutorial Pharmacy, 6th Ed, CBS Publishers & Distributors, New Delhi, 2004.
3. Bentley‘s Pharmaceutical Text Book, CBS Publishers & Distributors, New Delhi, 1986.
4. Remington‘s Pharmaceutical Sciences, 21st Ed, Mack Publishing Company, USA, 2005.
5. Good Pharmaceutical Manufacturing Practice, 6th Ed, John Sharp, Rational and Compliance. 2009.

PHM411
Pharmaceutics VA (Biopharmaceutics & Pharmacokinetics)
Course Objectives:-

The objectives of this course are to teach students the concepts of bioavailability and administration, absorption, distribution, metabolism and excretion of drugs. The students will also be able to learn the drug pharmacokinetic parameters, dosage regime design, therapeutic drug monitoring, *in-vivo* evaluation of drugs and their bioavailability studies.

Theory Course Outline:-

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

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

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

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

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

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

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

Lab Course Outline:-

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Blood Sampling Techniques (In Laboratory Animals like dog, rabbits, mice etc. in human beings), In-vitro dissolution studies, Optional dose determination, Measurement of rate of Bioavailability, Determination of relative and absolute bioavailability. Plasma level-time curve (Determination of Pharmacokinetic parameters). Determination of plasma protein binding. Urinary sampling techniques in laboratory animals. Renal excretion of drugs or drug disposition in animals and humans.

Recommended Books:
1. Applied Pharmacokinetics and Biopharmaceutics, Leon Shargel, Appleton & Lange, New York, 5th Ed., 2008.
2. Clinical Pharmacokinetics, Malcoln Rouland, Thomous N Tozer, William & Willkins, London, 1995.
3. Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Milo Gibaldi, Marchel & Dakker Inc, New York, 2008.

4. Introduction to Drug Metabolism, 3rd Ed, Gibbson and Skett, Champ & Hall, London, 2001.

5. Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Robert E Notari, Marchel & Dakker Inc, New York, 1988.

6. Text Book of Biopharmaceutics & Clinical Pharmacokinetics. Sarfraz Niazi, Appleton-Century-Crofts, New York, 1985.

7. Biopharmaceutics: Text Book for Pharmacy Students & Working Pharmacists, Gul Majid Khan, *[ISBN978-969-9101-00-7]*

8. Text Book of Biopharmaceutics & Pharmacokinetics for Post Graduate Students, Gul Majid Khan,

9. Laboratory Manual of Biopharmaceutics & Pharmacokinetics, Gul Majid Khan, *[ISBN 978-969-9101-02-1]*

10. Drug disposition and pharmacokinetics, Stephen H Curry, Black Well Scientific Publishing, Oxford, 1983.

11. Toxicokinetics and New Drug Development, Avraham Yacobi, Paramount Press, New York, 1989.

12. Biopharmaceutics of orally administered drugs, P Macheras, C Reppas and J B Dressman, Ellis Horwood Limited, London (1995).

13*In vitro* approaches for evaluation of drug efficacy and toxicity, Albert P Li, CRC Press LLC USA, 2004.

14. Pharmacokinetics in drug discovery and Development, Ronald D Schoenwald, CRC Press LLC, USA, 2002.

PHM412
Pharmaceutics VB (Biopharmaceutics & Pharmacokinetics)
Course Objectives:-

The objective of this course is to teach the students about the concepts of bioavailability and administration, absorption, distribution, metabolism and excretion of drugs. The students will also be able to learn the drug pharmacokinetic parameters, dosage regime design, therapeutic drug monitoring, *in-vivo* drug evaluation.

Theory Course Outline:-

1. ELIMINATION OF DRUGS:

i. Hepatic Elimination: Percent of Drug Metabolized, Drug Biotransformation reactions, (Phase-I reactions and phase-II reactions), First pass effect, Hepatic clearance of protein bound drugs and Biliary excretion of drugs.

ii. Renal Excretion of Drugs: Renal clearance, Tubular Secretion and Tubular Reabsorption.

iii. Elimination of Drugs through other organs: Pulmonary excretion, salivary excretion, Mammilary excretion, Skin excretion and Genital excretion.

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

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

4. PHARMACOKINETICS OF INTRAVENOUS INFUSIONS:

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

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

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

Lab Course Outline:-

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Blood Sampling Techniques (In laboratory animals like dog, rabbits, mice etc. in human beings), In-vitro dissolution studies, Optional dose determination, Measurement of rate of Bioavailability, Determination of relative and absolute bioavailability. Plasma level-time curve (Determination of Pharmacokinetic parameters). Determination of plasma protein binding. Urinary sampling techniques in laboratory animals. Renal excretion of drugs or drug disposition in animals and humans.

Recommended Books:

1 Applied Pharmacokinetics and Biopharmaceutics, Leon Shargel, Appleton & Lange, New York, 5th Ed., 2008.

2. Clinical Pharmacokinetics, Malcoln Rouland, Thomous N Tozer, William & Willkins, London, 1995.

3. Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Milo Gibaldi, Marchel & Dakker Inc, New York, 2008.

4. Introduction to Drug Metabolism, 3rd Ed, Gibbson and Skett, Champ & Hall, London, 2001.

5. Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Robert E Notari, Marchel & Dakker Inc, New York, 1988.

6. Text Book of Biopharmaceutics & Clinical Pharmacokinetics. Sarfraz Niazi, Appleton-Century-Crofts, New York, 1985.

7. Biopharmaceutics: Text Book for Pharmacy Students & Working Pharmacists, Gul Majid Khan, *[ISBN978-969-9101-00-7]*

8. Text Book of Biopharmaceutics & Pharmacokinetics for Post Graduate Students, Gul Majid Khan,

9. Laboratory Manual of Biopharmaceutics & Pharmacokinetics, Gul Majid Khan, *[ISBN 978-969-9101-02-1]*

10. Drug disposition and pharmacokinetics, Stephen H Curry, Black Well Scientific Publishing, Oxford, 1983.

11. Toxicokinetics and New Drug Development, Avraham Yacobi, Paramount Press, New York, 1989.

12. Biopharmaceutics of orally administered drugs, P Macheras, C Reppas and J B Dressman, Ellis Horwood Limited, London (1995).

13. *In vitro* approaches for evaluation of drug efficacy and toxicity, Albert P Li, CRC Press LLC USA, 2004.

14. Pharmacokinetics in drug discovery and Development, Ronald D Schoenwald, CRC Press LLC, USA, 2002.

PHM415
Pharmaceutics VIA (Pharmaceutical Quality Management)
Course Objectives: -

The contents of this course will develop, among students, understanding of the major principles of the quality assurance, testing, quality control and methods adopted in a pharmaceutical industry for the dosage form control, process control, testing program and methods which include physical, chemical and biological tests and their specifications. After completion of this course the students will also be able to use statistical tools for continuous improvement in the quality of products.

Theory Course Outline:

1. INTRODUCTION:

i. Basic concepts and introduction of pharmaceutical industry in relevance to quality assurance and quality control departments, testing, quality management system, quality assurance, quality control and quality standards.

ii. General understanding of good laboratory practices and validation

2. QUALITY CONTROL OF SOLID DOSAGE FORMS:

i. Physical tests: Hardness, Thickness and Diameter, Friability, Disintegration, Weight Variation.

ii. Chemical tests: Content uniformity, Assay of active Ingredient and dissolution tests of Powders, Granules, Tablets and Capsules.

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

4. QUALITY CONTROL OF SUPPOSITORIES: Dissolution test, Uniformity of weight, Assay of active Ingredient, Liquefaction time test and Breaking test.

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

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

Lab Course Outline:

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Assay of various spirits, tinctures, extracts, syrups and elixirs, Assay of Ointments and suppositories, Assay of tablets and capsules, Test for alkalinity of glass, Determination of alcohol contents in the Pharmaceutical preparations and Pyrogen test. Sterility test, Determination of Ash contents, Determination of Moisture contents, Determination of total solids, Determination of viscosity of syrups, gels, etc., Determination of emulsion types (Note: A minimum of 10 practicals will be performed).

Recommended Books:

1. Practical Pharmaceutical Chemistry, Part-I and II. A H Beckett and J B Stennlake, The Alton Press, London. 2001.
2. Jenkin's Quantitative Pharmaceutical Chemistry, A M Knevel and F E Digangi,McGraw-Hill Book Company, New York. 1977.
3. A Text Book of Pharmaceutical Analysis, 3rd Ed, K A Connors, John-Wiley and Sons, New York. 1999.
4. Chromatographic Methods, A Braithwaite and F J Smith, Chapman and Hall, London. 1995.
5. Analytical Chemistry, G D Christian, John Wiley and Sons, New York. 2003.
6. Pharmaceutical Quality Assurance in Class, Industry and Market, Karamt A Javaid, Aziz Publishers, Lahore-Pakistan, 1993.
7. Cleaning Validation, A practical approach. Gil Bismuth and Shosh Neumann, CRC Press, LLC, USA, 2003.
8. Drug Stability: Principles and Practices, 3rd edition (revised and expanded) J T Carstersen and C T Rhodes, Mercel Dekker, New York. 2000.
9. Good Manufacturing Practices for Pharmaceuticals. 5th Ed, Sydney H Willig, Marcel Dekker Publishing.2000.
10. The pharmaceutical Quality Control Hand Book, Bryant R, Aster Publishing Corporation, Eugene, 1989.
11. Introduction to Instrumental Analysis, Braun R E, McGraw-Hill Book Co, NY, 1987.

PHM416
Pharmaceutics VIB (Pharmaceutical Quality Managements)
Course Objectives: -

The objectives of this course are to teach students different kinds of teats used for the quality assurance, testing and quality control of pharmaceuticals. These methods will include physical, chemical and biological tests and their specifications. This course will also enable students to use statistical tools for continuous improvement in the quality of products.

Theory Course Outline:-

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

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

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

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

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

6. STATISTICAL INTERPRETATION OF QUALITY CONTROL CHARTS DURING MANUFACTURING PROCESS.

Lab Course Outline:-

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

Recommended Books:

1. Practical Pharmaceutical Chemistry, Part-I and II. A H Beckett and J B Stennlake, The Alton Press, London. 2001.
2. Jenkin‘s Quantitative Pharmaceutical Chemistry, A M Knevel and F E Digangi,McGraw-Hill Book Company, New York. 1977.
3. A Text Book of Pharmaceutical Analysis, 3rd Ed, K A Connors, John-Wiley and Sons, New York. 1999.
4. Chromatographic Methods, A Braithwaite and F J Smith, Chapman and Hall, London. 1995.
5. Analytical Chemistry, G D Christian, John Wiley and Sons, New York. 2003.
6. Pharmaceutical Quality Assurance in Class, Industry and Market, Karamt A Javaid, Aziz Publishers, Lahore-Pakistan, 1993.
7. Cleaning Validation, A practical approach. Gil Bismuth and Shosh Neumann, CRC Press, LLC, USA, 2003.
8. Drug Stability: Principles and Practices, 3rd edition (revised and expanded) J T Carstersen and C T Rhodes, Mercel Dekker, New York. 2000.
9. Good Manufacturing Practices for Pharmaceuticals. 5th Ed, Sydney H Willig, Marcel Dekker Publishing.2000.
10. The pharmaceutical Quality Control Hand Book, Bryant R, Aster Publishing Corporation, Eugene, 1989.
11. Introduction to Instrumental Analysis, Braun R E, McGraw-Hill Book Co, NY, 1987.

PHM501
Pharmaceutical Chemistry IVA (Medicinal Chemistry)
Course Objectives:

Objective of teaching this paper of medicinal chemistry to pharmacy students include; To develop among students the understanding of chemical constitution and biological activity of drug compounds. To teach the students about drug design and development. To teach them chemistry, biological activity, relationship between structure and activity and therapeutic applications of various classes of drug compounds. After completing this course students will be able to understand the applications of medicinal chemistry for pharmaceutical drug design, development and manufacturing.

Theory Course Outline:-

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

2. DRUG TARGETS AND DRUG DESIGNING:

Introduction and types of drug targets, Introduction to molecular modeling and computational chemistry, Structure based designing,. Ligand based designing, Various techniques in drug synthesis

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

i. Hormones: Steroidal Hormones (Testosterone, Progesterone, Estrogen, Aldosteron and Cortisol), Proteinous Hormones (Insulin, Glucagon, Oxytocin and Vassopressin).

ii. Anti-neoplastic Agents: Tamoxifen, Fluorouracil, Mercapturine, Methotrexate and Vincristine.

iii. Sedatives & Hypnotics: Benzodiazepines, Barbiturates, Paraldehyde, Glutethimide, Chloral hydrate, and alcohols.

iv. Anaesthetics: Local anaesthetics (Procaine, Lignocaine, Eucaine, Cocaine and Benzocaine), General anaesthetics (Cyclopropane, Halothane, Nitrous oxide, Chloroform, Thiopental Sodium, Ketamine, Methohexital, Thioamylal Sodium, Fantanyl Citrate, Tribromo ethanol).

v. Analgesics and Antipyretics: Paracetamol, Salicylic acid analogues, Quinolines derivatives, Pyrazolone and Pyrazolodiones, N- arylanthranilic acids, Aryl and heteroaryl acetic acid derivatives.

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

Laboratory Course Outline:-

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

Recommended Books

1. Remington Practice of Pharmaceutical Science, 12th Ed, Martin and Cook, Mack Publishing Company, USA, 2001
2. Principles of Medicinal Chemistry, 6th Ed, Foye W O, Verghese Publising House, Bomby, 2008.
3. Textbook of Synthetic Drugs, Tyagi, Anmol Publications, Delhi, 1990.
4. Medicinal Chemistry, 6th Ed, Alferd Burger, Jhon Willey & Sons, New York, 2003.
5. Inorganic and Medicinal Pharmaceutical Chemistry, Block, Roche, Soine and Wilson, Verghese Publishing House, Bombay, 1986.

PHM502
Pharmaceutical Chemistry IVB (Medicinal Chemistry)

Course Objectives:-

This course has been designed to teach the students chemistry, biological actions, relationship between structure and activity and therapeutic applications of various classes of organic drug compounds and properties, preparations and pharmaceutical importance of official inorganic compounds. This course will help students to understand the applications of many synthetic medicinal compounds in different drug formulations.

Theory Course Outline:-

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

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

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

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

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

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

vi. Immunosuppressant Agents: Azathioprine and Cyclosporin.

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

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

Lab Course Outline:-

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

Recommended Books:

1 Remington Practice of Pharmaceutical Science, 12th Ed, Martin and Cook, Mack Publishing Company, USA, 2001

2. Principles of Medicinal Chemistry, 6th Ed, Foye W O, Verghese Publising House, Bomby, 2008.

3. Textbook of Synthetic Drugs, Tyagi, Anmol Publications, Delhi, 1990.

4. Medicinal Chemistry, 6th Ed, Alferd Burger, Jhon Willey & Sons, New York, 2003.

5. Inorganic and Medicinal Pharmaceutical Chemistry, Block, Roche, Soine and Wilson, Verghese Publishing House, Bombay, 1986.

PHM505
Pharmacy Practice VIA (Advanced Clinical Pharmacy II)
Course Objectives:-

The objective of this course is to develop among students understanding about the practice of pharmacy in clinical setting especially in a hospital. After completing this course students will be able to understand the concept of rational use of drugs, essential drugs & their advantages, drug utilization evaluation & review, practical pharmacokinetics and the role of pharmacist in pharmaceutical care, its scope, management and application.

Theory Course Outline:-

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

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

3. DISEASE MANAGEMENT:

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

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

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

Lab Course Outline:-

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

Recommended Books:

1. Clinical Pharmacy & Therapeutics, Roger Walker, Churchill Levingstone, London, 4th Ed., 2003.
2. A Behavioral Approach to Pharmacy Practice, Guard Paul, Black Well, USA, 2000.
3. Clinical Pharmacy & Therapeutics, 4th Ed, Herfindal Gourley, William & Willkins, London, 1992.
4. Pharmaceutical Practice, A J Winfield, Churchill Levingstone, London, 3rd Ed., 1998.
5. Pharmacy Practice, 2nd Ed, Kavin Taylor, Taylor & Francis, New York, 1998.
6. Clinical Research Coordinator Hand Book, 4th Ed., Deborah Rosenbaun, Sarrison, Inc, North Carolina, USA. 2001.
7. Clinical Studies Management, a Practical Guide to Success, Simon Cook, Sue Horwood Publishing limited, and West Sussex UK. 2004.
8. Encyclopedia of Clinical Pharmacy. Joseph T Dipiro, Marcel Dekker Publishing, 2003.
9. Pharmacist Talking with Patients, 2nd Ed, Mellainie J Rantucci, 2006.
10. Oxford Text Book of Clinical Pharmacology and Drug Therapy, Smith GDG and Aronson J K, Oxford University Press, UK, 2002.
11. Drug interactions. Hansten P and Horn J, Lee & Febiger, Philadelphia,USA, 1989.

PHM506
Pharmacy Practice VIB (Advanced Clinical Pharmacy II)
Course Objectives:-

The objective of this course is to develop among students understanding about the practice of pharmacy in clinical settings especially in hospitals. After completing this course students will be able to understand the role of pharmacists in community pharmacy, clinical therapeutics, clinical toxicology and about safe intra venous therapy and hazards of intravenous therapy.

Theory Course Outline:

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

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

3. DISEASE MANAGEMENT:

- Unit VIII : Oncology Unit (Types of tumors, Introduction to Oncological diseases e.g., Prostate cancer, Breast cancer, Lungs cancer)
- Unit IX: Nephrology Unit (Renal failure, nephrotic syndrome)
- Unit X: Hematology Unit (Bleeding disorders/coagulopathies/ clotting disorders e.g. thrombocytopenia, hemophilia, Vit. K deficiency, Anemia)

4. CLINICAL TOXICOLOGY:
a. General information. Role of pharmacist in treatment of poisoning and general management of poisoning & over dosage. Role and status of Poison Control Centre.
b. Antidotes and their mechanism of action.

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

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

Lab Course Outline:-

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

Recommended Books:

1. Clinical Pharmacy & Therapeutics, Roger Walker, Churchill Levingstone, London, 4th Ed., 2003.
2. A Behavioral Approach to Pharmacy Practice, Guard Paul, Black Well, USA, 2000.
3. Clinical Pharmacy & Therapeutics, 4th Ed, Herfindal Gourley, William & Willkins, London, 1992.
4. Pharmaceutical Practice, A J Winfield, Churchill Levingstone, London, 3rd Ed., 1998.
5. Pharmacy Practice, 2nd Ed, Kavin Taylor, Taylor & Francis, New York, 1998.
6. Clinical Research Coordinator Hand Book, 4th Ed., Deborah Rosenbaun, Sarrison, Inc, North Carolina, USA. 2001.
7. Clinical Studies Management, a Practical Guide to Success, Simon Cook, Sue Horwood Publishing limited, and West Sussex UK. 2004.
8. Encyclopedia of Clinical Pharmacy. Joseph T Dipiro, Marcel Dekker Publishing, 2003.
9. Pharmacist Talking with Patients, 2nd Ed, Mellainie J Rantucci, 2006.

10. Oxford Text Book of Clinical Pharmacology and Drug Therapy, Smith GDG and Aronson J K, Oxford University Press, UK, 2002.
11. Drug interactions. Hansten P and Horn J, Lee & Febiger, Philadelphia,USA, 1989.
12. Inject able drug development, Pramod K Gupta, CRC Press, LLC, USA, 1999.
13. Introduction to the principals of drug design and action, 4th Ed, H John Smith, CRC Press, LLC, USA, 2005.
14. Water Insoluble Drug Formulations, 2nd Ed, Rong Liu, CRC Press, LLC, USA, 2008.
15. Twenty First Century Pharmaceutical Development. Peter Blaisdell, CRC Press, LLC, USA, 2000.
16. Theory and Practice of Industrial Pharmacy, 3rd Ed, Lachman,Verghese Publishing House, Bombay, 2009.

PHM509
Pharmaceutics VIIA (Pharmaceutical Technology)
Course Objectives:-

By studying the contents of this course, the students will learn the techniques and methods of formulation development especially with reference to advanced formulation techniques and novel drug delivery systems.

Theory Course Outline:-

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

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

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

3. POLYMERS USED IN DRUG DELIVERY SYSTEMS:

4. NOVEL DRUG DELIVERY SYSTEM (DDS):

Sustained/ Controlled Release Drug Delivery System
i) Microencapsulation technique

- Coacervation
- Solvent evaporation
- Interfacial polymerization
- Spray drying

ii) Developmental aspects of Matrix and Reservoir Systems

Lab Course Outline: -

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. Various techniques to develop the formulation, Granulation technology, Study of drug delivery systems, In-vitro Quality Control of various dosage forms. Particle size analysis using various methods, Stability studies of Pharmaceuticals. Preparation and Coating of particles. (Note: A minimum of 10 practicals will be performed).

Recommended Books

1. Drug delivery and targeting, 13th Ed, Anya M. Hellery, Taylor & Francis, London, 2001.
2. Controlled drug delivery, Joseph R Robinson Marcel & Dakker Inc, New York, 2nd Ed., 1992.

3. Pharmaceutical design and development, T V Ramabhadran, Ellis Horwood, New York, 1994.
4. Pharmaceutics: Science of Dosage Forms Design, M E Aulton, ELBS/Churchill Livingstone, London, 1998.
5. Modern pharmaceutics, Banker, Marchell Dakker Inc, New York, 2002.
6. Development of biopharmaceutical parenteral dosage forms, John A Bontempo, Marchell Dakker Inc, New York, 1997.
7. Controlled and Novel drug delivery, N K Jain, CBS Publishers & Distributers, New Delhi, 2004.
8. Pharmaceutical Dosage Form in Drug Delivery System, Ansel, Lee & Febiger, London,2004.
9. Bioassay techniques for drug development, Attaurahman and M I Chaudry, CRC Press, LLC, USA, 2001.

Pharmaceutics VIIB (Pharmaceutical Technology)
Course Objectives:-

By studying this course students will learn different techniques and methods of formulation development especially with reference to advanced formulation techniques, modified drug release and the use of pharmaceutical bio-technology in product development and genetic engineering and its application in medicines.

Theory Course Outline:-

1. NOVEL GIT DRUG DELIVERY SYSTEM:

i. Oral Osmotic Pumps

ii. Ion-Exchange Controlled DDS

iii. pH-Controlled DDS

iv. Bio/mucoadhesive DDS

v. Floating DDS

2. DRUG CARRIER SYSTEM:

i. Liposomes

ii. Niosomes

3. TARGETED DRUG DELIVERY SYSTEM:

i. Active Drug Delivery System

ii. Passive Drug Delivery System

4. PHARMACEUTICAL BIOTECHNOLOGY:

i. Introduction to Biotechnology: Genetics/Genomics, Proteomics, Biomolecular target Identification, Pharmacogenomics, Gene therapy and Nucleic acid therapeutics.

ii. Techniques Used in Pharmaceutical biotechnology: PCR, DNA Sequencing, Affinity Protein Purification.

iii. Fundamentals of Genetic Engineering and its Application in Medicine.

iv. Pharmaceutical Recombinant therapeutic Proteins, Growth factors, Therapeutic antibodies, High-throughput screening of putative therapeutic compounds.

v. Biotechnological aspects in the product development.

vi. Principle, Synthesis and Application of Monoclonal Antibodies.

vii. Immobilized Enzymes and their application in Medicine.

Lab Course Outline:-

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

Recommended Books:

1. Drug delivery and targeting, 13th Ed, Anya M. Hellery, Taylor & Francis, London, 2001.
2. Controlled drug delivery, Joseph R Robinson Marcel & Dakker Inc, New York, 2nd Ed., 1992.
3. Pharmaceutical design and development, T V Ramabhadran, Ellis Horwood, New York, 1994.
4. Pharmaceutics: Science of Dosage Forms Design, M E Aulton, ELBS/Churchill Livingstone, London, 1998.
5. Modern pharmaceutics, Banker, Marchell Dakker Inc, New York, 2002.
6. Development of biopharmaceutical parenteral dosage forms, John A Bontempo, Marchell Dakker Inc, New York, 1997.
7. Controlled and Novel drug delivery, N K Jain, CBS Publishers & Distributers, New Delhi, 2004.
8. Pharmaceutical Dosage Form in Drug Delivery System, Ansel, Lee & Febiger, London,2004.
9. Bioassay techniques for drug development, Attaurahman and M I Chaudry, CRC Press, LLC, USA, 2001.

PHM513
Pharmacy Practice VIIA (Forensic Pharmacy)
Course Objectives:-

Study of this course will enable the students to become aware about the regulatory control of manufacturing and sale of drugs in Pakistan. The students will be able to know about the laws and procedures regarding Registration and sale of drugs, establishment of retail, wholesale and distribution set ups. By studying this course students will also be able to gain knowledge of Rules and legislation about controlled, poisonous and dangerous drugs.

Course Outline

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

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

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

4. STUDY OF DRUG LAWS:

i. The Drugs Act 1976 and rules framed there under.

ii. Provincial Drug Rules (Respective Drug Rules will be taught in the relevant province).

iii. Advertisement rules.

iv. Other Related rules and Legal aspects.

Recommended Books:

1. The Manual of Drug Laws in Pakistan, R Z Hussain, Irfan Law Book House, Lahore-Pakistan (2003).
2. Textbook of Forensic Pharmacy, C.K. Kokate and S.B. Gokhale. Pharma Book Syndicate, 2006 ISBN : 81-88449-17-
3. The Pharmacy Act 1967.
4. The Poisons Act 1919.
5. The Factory Law 1934.
6. Shop and Establishment Ordinance 1969.

7. Control of Narcotics Substances Act 1997.

PHM514
Pharmacy Practice VIIB (Forensic Pharmacy)
Course Objectives:-

Study of this subject will enable the students to become aware about the regulatory control of manufacturing and sale of drugs in Pakistan. The students will be able to know about the laws and procedures regarding Registration and sale of drugs, establishment of pharmaceutical factory, wholesale and distribution set ups. The students will also get knowledge of Rules and legislation about controlled, poisonous and dangerous drugs.

Course Outline:

1. THE PHARMACY ACT 1967:

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

3. THE POISONS ACT 1919:

4. THE FACTORIES ACT 1934:

5. SHOPS AND ESTABLISHMENTS ORDINANCE 1969 WITH RULES:

Recommended Books:
1. The Manual of Drug Laws in Pakistan, R Z Hussain, Irfan Law Book House, Lahore-Pakistan (2003).
2. Textbook of Forensic Pharmacy, C.K. Kokate and S.B. Gokhale. Pharma Book Syndicate, 2006 ISBN : 81-88449-17-
3. The Pharmacy Act 1967.
4. The Poisons Act 1919.
5. The Factory Law 1934.
6. Shop and Establishment Ordinance 1969.
7. Control of Narcotics Substances Act 1997.

PHM515
Pharmacy Practice VIIIA (Pharmaceutical Management and Marketing)
Course Objectives:-

Pharmaceutical marketing and management course will enable the students to learn about different principles of management and marketing. This course will prepare the students as how to manage different tasks, planning of objectives, how to manage long term and short term targets in pharmaceutical industry, marketing and retail set-ups, strategies to accomplish different goals and management of different tasks within a specified period of time.

Course Outline:

1. MANAGEMENT & MARKETING:

i. Nature and Principles of Management

ii. Types and Functions of Managers

iii. Planning: Purpose and types of Planning, Steps in Planning

iv. Organizing

v. Management Control Systems. Purpose: Steps in the Control Process, Forms of Operations control. Requirements for adequate control, Critical control points and standards

vi. Motivation

vii. Innovation and creativity

viii. Principals of Marketing

ix. Product Management

x. Marketing Research

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

Recommended Books:

1. Pharmaceutical Management and Marketing, M Ahmad & N I Bukhari, Tariq Academy, Faslabad-Pakistan, 2002.

2. Pharmacy Management for students and practitioners, C Patrick Tharp & Pedro J Lecca, The C V Mosby Company, St. Louis, Toronto, London, 1979.

3. Principles & Methods of Pharmacy Management, Harry A Smith, Lea & Febiger, Philadelphia, 1986.

4. Effective Business Communication, 8th Edition, Herta A. Murphy, Herbert W. Hildebrandt, Jeans P. Thomas, 2009

PHM516

Pharmacy Practice VIIIB (Pharmaceutical Management and Marketing)

Course Objectives:-

This Pharmaceutical Management and marketing course will enable the students to learn about different principles of marketing and sales management. This course will develop among students the understanding of Pharmacy layout design.

Course Outline:-

1. MARKETING MANAGEMENT:

i. Ethical consideration of Pharmaceutical Marketing

ii. Difference between Pharmaceutical Marketing and Consumer Marketing

iii. Major stakeholders within pharmaceutical market environment.

iv. Marketing Research (Process and Methodology)

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

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

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

viii. Marketing channels, Promotion and Advertising and Salesmanship.

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

Recommended Books:

1 Pharmaceutical Management and Marketing, M Ahmad & N I Bukhari, Tariq Academy, Faslabad-Pakistan, 2002.

2. Pharmacy Management for students and practitioners, C Patrick Tharp & Pedro J Lecca, The C V Mosby Company, St. Louis, Toronto, London, 1979.

3. Principles & Methods of Pharmacy Management, Harry A Smith, Lea & Febiger, Philadelphia, 1986.

4. Effective Business Communication, 8th Edition, Herta A. Murphy, Herbert W. Hildebrandt, Jeans P. Thomas, 2009