NEW SCHEME OF COURSES FOR PHARM-D

(FIVE YEAR SEMESTER SYSTEM)

1ST Professional Pharm-D

Semester- I			Semester-II		
COURSE NO	**SUBJECT**	**CR HR**	**COURSE NO**	**SUBJECT**	**CR HR**
ENG-300	English-A (F English)	2	ENG-301	English-B (Communication & Writing skills)	2
PD-301	Physical Pharmacy-I [Th]	3	PD-302	Physical Pharmacy-II [Th]	3
PD-303	Physical Pharmacy-I [Lab]	1	PD-304	Physical Pharmacy-II [Lab]	1
PD-305	Pharmaceutical Mathematics	3	PD-306	Pharmaceutical Organic Chemistry-II [Th]	3
PD-307	Pharmaceutical Organic Chemistry –I [Th]	3	PD-308	Pharmaceutical Organic Chemistry-II [Lab]	1
PD-309	Pharmaceutical Organic Chemistry –I [Lab]	1	PD-310	Pharmaceutical Biochemistry-II [Th]	3
PD-311	Pharmaceutical Biochemistry-I [Th]	3	PD-312	Pharmaceutical Biochemistry-II [Lab]	1
PD-313	Pharmaceutical Biochemistry-I [Lab]	1	PD-314	Physiology - II [Th]	3
PD-315	Physiology - I [Th]	3	PD-316	Physiology [Lab]	2
PD-317	Anatomy & Histology-I [Th]	2	PD-318	Anatomy & Histology-II [Th]	2
			PD-320	Anatomy & Histology [Lab]	1
	Total Cr. Hr	**22**		**Total Cr. Hr**	**22**

2nd Professional Pharm-D

Semester-III			Semester-IV		
Course No	Subject	Cr Hr	Course No	Subject	Cr Hr
ISL-400	Islamic Studies	2	PKS-401	Pakistan Studies	2
PD-401	Pharmaceutical Microbiology and Immunology- I [Th]	3	PD-402	Pharmaceutical Microbiology and Immunology - II [Th]	3
PD-403	Pharmaceutical Microbiology and Immunology -I [Lab]	1	PD-404	Pharmaceutical Microbiology and Immunology -II [Lab]	1
PD-405	Pharmaceutical Preparation and Dosage form Science-I [Th]	3	PD-406	Pharmaceutical Preparation and Dosage form Science -II [Th]	3
PD-407	Pharmaceutical Biostatistics	3	PD-408	Pharmaceutical Preparation and Dosage form Science [Lab]	2
PD-409	Pharmacology & Therapeutics -I [Th]	3	PD-410	Pharmacology & Therapeutics -II [Th]	3
PD-411	Pharmacology & Therapeutics -I [Lab]	1	PD-412	Pharmacology & Therapeutics -II [Lab]	1
PD-413	General Pharmacognosy [Th]	3	PD-414	Pathology-I [Th]	2
PD-415	Pharmacognosy - I [Lab]	1	PD-416	Chemical Pharmacognosy [Th]	3
			PD-418	Pharmacognosy - II [Lab]	1
	Total Cr. Hr	**20**		**Total Cr. Hr**	**21**

3rd Professional Pharm-D

Semester- V			Semester- VI		
Course No	Subject	Cr Hr	Course No	Subject	Cr Hr
PD-501	Pharmacology & Therapeutics-III [Th]	3	PD-502	Pharmacology & Therapeutics –IV [Th]	3
PD-503	Pharmacology & Therapeutics-III [Lab]	1	PD-504	Pharmacology & Therapeutics-IV [Lab]	1
PD-505	Pathology-II [Th]	2	PD-506	Computer & its Application in Pharmacy [Th]	3
PD-507	Pathology [Lab]	1	PD-508	Computer & its Application in Pharmacy [Lab]	1
PD-509	Pharmaceutical Analysis and Instrumentation-I [Th]	3	PD-510	Pharmaceutical Analysis and Instrumentation-II [Th]	3
PD-511	Pharmaceutical Analysis and Insturmentaion-I [Lab.]	1	PD-512	Pharmaceutical Analysis and Insturmentaion-II [Lab.]	1
PD-513	Advanced Pharmacognosy - I [Th]	3	PD-514	Advanced Pharmacognosy - II [Th]	3
PD-515	Pharmacognosy - III [Lab]	1	PD-516	Pharmacognosy - IV [Lab]	1
PD-517	Compounding & Dispensing Pharmacy [Th]	3	PD-518	Community Pharmacy [Th]	3
PD-519	Compounding & Dispensing Pharmacy [Lab]	1			
	Total Cr. Hr	**19**		**Total Cr. Hr**	**19**

4th Professional Pharm-D (NEW)

Course No	Subject	Cr Hr	Course No	Subject	Cr Hr
PD-601	Hospital Pharmacy-I [Th]	3	PD-602	Hospital Pharmacy-II [Th]	3
PD-603	Industrial Pharmacy-I [Th]	3	PD-604	Industrial Pharmacy-II [Th]	3
PD-605	Industrial Pharmacy-I [Lab]	1	PD-606	Industrial Pharmacy-II [Lab]	1
PD-607	Pharmaceutical Quality Management-I [Th]	3	PD-608	Pharmaceutical Quality Management-II [Th]	3
PD-609	Pharmaceutical Quality Management-I [Lab]	1	PD-610	Pharmaceutical Quality Management-II [Lab]	1
PD-611	Clinical Pharmacy- I [Th]	3	PD-612	Clinical Pharmacy –II [Th]	3
PD-613	Clinical Pharmacy-I [Lab]	1	PD-614	Clinical Pharmacy-II [Lab]	1
PD-615	Clinical Pharmacognosy [Th]	3	PD-616	Medicinal Chemistry-II [Th]	3
PD-617	Medicinal Chemistry-I [Th]	2	PD-618	Medicinal Chemistry-I [Lab]	1
	Total Cr. Hr	**20**		**Total Cr. Hr**	**19**

5th Professional Pharm-D

Semester IX			Semester X		
Course No	Subject	Cr Hr	Course No	Subject	Cr Hr
PD-701	Clinical Pharmacy-III [Th]	3	PD-702	Clinical Pharmacy-IV [Th]	3
PD-703	Clinical Pharmacy-III [Lab]	1	PD-704	Clinical Pharmacy-IV [Lab]	1
PD-705	Pharmaceutical Technology-I [Th]	3	PD-706	Pharmaceutical Technology-II [Th]	3
PD-707	Forensic Pharmacy-I [Th]	2	PD-708	Pharmaceutical Technology [Lab]	2
PD-709	Biopharmaceutics & Pharmacokinetics-I [Th]	3	PD-710	Forensic Pharmacy-II [Th]	2
PD-711	Pharmaceutical Marketing & Management-I [Th]	3	PD-712	Biopharmaceutics & Pharmacokinetics -II [Th]	3
PD-713	Medicinal Chemistry- III [Th]	3	PD-714	Biopharmaceutics & Pharmacokinetics [Lab]	2
PD-715	Medicinal Chemistry- II [Lab]	1	PD-716	Pharmaceutical Marketing & Management-II [Th]	3
	Total Cr. Hr	**19**		**Total Cr. Hr**	**19**

SUMMARY OF COURSES CR.Hrs

	1st Semester	2nd Semester	Total
	Cr. Hrs	Cr. Hrs.	Cr. Hrs
1st Prof.	22	22	44
2nd Prof	20	21	41
3rd Prof	19	19	38
4th Prof	20	19	39
5th Prof	19	19	38
Total	**100**	**100**	**200**

FIRST PROFESSIONAL

SEMESTER FIRST:

ENGLISH-A (FUNCTIONAL ENGLISH) **Cr.Hr.02**

ENG 300

Objectives: Enhance language skills and develop critical thinking.

Course Contents:

- Basics of Grammar: Parts of speech and use of articles. Sentence structure, active and passive voice; Practice in unified sentence. Analysis of phrase, clause and sentence structure. Transitive and intransitive verbs, punctuation and spelling.
- Comprehension: Answers to questions on a given text.
- Discussion: General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students).
- Listening: Improve listening skills by showing documentaries/films carefully selected by subject teacher.
- Translation skills: Urdu to English.
- Paragraph writing: Topics to be chosen at the discretion of the teacher.
- Presentation skills: Introduction & practice to improve presentation skills.

NOTE: Extensive reading is required for vocabulary building.

PHYSICAL PHARMACY- I [TH]
PD- 301 **Cr. Hrs. 03**

1) PHARMACY ORIENTATION

Introduction and orientation to the profession of pharmacy in relation to Hospital Pharmacy, Retail pharmacy, Industrial pharmacy, Forensic Pharmacy, Pharmaceutical education and research etc.

2) ETHICS IN PHARMACY: Brief introduction of ethics for pharmacy profession.

3). HISTORY OF PHARMACY:

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.

4). LITERATURE OF PHARMACY: Introduction to literature of pharmacy. An introduction of various official books such as Pharmacopoeia, formularies, codices, abstracts etc.

5). PHYSICOCHEMICAL PROCESSES

a). Precipitation: Processes of precipitation and its application in Pharmacy.

b). Crystallization: Types of crystals, Mechanism and methods of crystallization and its applications in pharmacy.

c). Distillation: Simple distillation, fractional distillation, steam distillation, vacuum distillation, destructive distillation and their applications in pharmacy.

d). Adsorption Techniques: Adsorption Techniques and processes of adsorption in detail.

e). Miscellaneous Processes: Efflorescence, deliquescence, lyophillization, elutriation, exsiccation, ignition, sublimation, fusion, decantation, evaporation, vaporization, centrifugation, desiccation, levigation and tritruration.

6). PHYSICO -CHEMICAL PRINCIPLES:

a). Solutions: Introduction, types, concentration expression methods, ideal and real solution, colligative properties, their mathematical derivation and applications in pharmacy, molecular weight determination, Distribution co-efficient and its applications in pharmacy.

b). Solubilization: Solubility, factors affecting solubility, surfactants their properties and types. Micelles, their formulation and types.

c). Ionization: pH, pH indicator, pka buffers, buffer's equation, Isotonic solution and their applications in pharmacy.

RECOMMENDED BOOKS:

1). Martin, Physical Pharmacy, B.I Waverty Pvt, Dehli 4th Ed. 1994.

2). Cooper and Gunn's Tutorial Pharmacy, CBS Publishers & Distributors, New Dehli, 1986.

3). Bentley's, Pharmaceutics, All India Traveler Book Seller, New Dehli 1996.

4). Martin. P. Bustamante, P and Chun, Physical & Clinical Principal's of Pharmaceutical Science, A.H.C 4th Edition (1999), New York.

5). Martin A. M. N, Banker G.S. and Chun A.H.C Advance in Pharmaceutical Sciences. Academic Press London. 1985.

6). Mill C.C. Casson N. Rheology of disperse system, Pergamon Press, New Dehli, 1975.

7). Rienger M and Scott-Blair. G. W Reology Academic Press London 1972.

8). Barry B. W. Advances in Pharmaceutical Sciences, Academic Press, London. 1990.

9). Sherman P. Emulsion Sciences. Academic Press, London 1972.

10). Martine A. Swarbrick J. and Cammatra A. Physical Pharmacy 3rd Ed. Lee & Febiger, Philadelphia. 1983.

11). Attwood D. and Florence A. T. Surfactant System. Chapman and I tall Ltd. London, 1982.

12). Remington's Pharmaceutical Sciences, Mack Publisher Company USA, 2001.

PHYSICAL PHARMACY-I [LAB]
PD- 303 **Cr. Hrs. 01**

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

PHARMACEUTICAL MATHEMATICS

COURSE # PD-305 Cr. Hr. 03

1). ALGEBRA:

a). Set and Functions:
Elementary concepts of sets. Concept of Function, Domain and Range of a Function. Different types of Functions. Graphical representation of a function some applications of Function.

b). Solution of linear and Quadratic Equations. Equations reducible to Quadratic form Solution of simultaneous Equation.

c). Arithmetic, Geometric and Harmonic Progressions. Arithmetic, Geometric and Harmonic Means

d). Permutations and combinations.

e). Binomial Theorem: Simple application.

2). TRIGONOMETRY:
Measurement of angles in Radian and degree. Definition of circular functions. Derivation of circular function for simple cases.

3). ANALYTICAL GEOMETRY;
Coordinates of points in a plane. Distance between two points in a plane Locus, Equations of Straight line, Equation of Parabola, Circle and Ellipse.

4). DIFFERENTIAL CALCULUS:
Concept of derivation Rule of Differentiation Examples on the evaluation of Derivations. Derivatives of Exponential and Logarithmic Functions, Partial Derivations Higher order Derivatives. Maxima & Minima points of Inflection.

Z**5). INTEGRAL CALCULUS:**
Concept of integration. Rules of integrations. Integrations of Algebra and Trigonometric functions by using different techniques.

RECOMMENDED BOOKS:

1). C. H. Edwards. Jr. and David E Penney, Calculus and Analytic Geometry. Prentice--Hall, Inc. A division of Simon & Schuster Englewood Gliffs, New Jersey 07632, USA. 1995.

2). Ahmed, B. and Khan, M. Mathematics for Pharmacists, Arsalan paper Mart: Multan. 1993.

PHARMACEUTICAL ORGANIC CHEMISTRY-I TH]
COURSE # PD-307 **Cr. Hrs. 03**

1). **(a).** Introduction to Pharmaceutical Chemistry**,** classification **&**nomenclature of Organic Pharmaceutical compounds.

(b). **BASIC CONCEPTS:** Conjugation, hyper conjugation, steric effect, inductive effect, mesomeric effect, hydrogen bonding. Theory of resonance. Effect of structure on reactivity compound. Tautomerism of carbonyl compounds.

2). **NUCLEOPHILIC AND ELECTROPHILIC SUBSTITUTION REACTION IN ALIPHATIC AND AROMATIC SYSTEM.**

3). **ORIENTATION IN ELECTROPHILIC SUBSTITUTION REACTIONS ON BENZENE RING.**

4). **ORGANIC REACTION :** Baeyer –villiger oxidation: Diels Alder reaction, Grignard's reaction, Metal hydride reduction and Wolf Kishner reduction. Friedel craft's reaction, Perkin reaction, Cannizzaro reaction, Wolf Kisher reduction.

5). **CARBONIUM ION REARRANGEMENTS & THEIR STABILITY:**

Pinacolone, Wagner-Merrwein, Wolf, Hofmann and Beckmann rearrangements.

6). **CARBANIONS & THEIR STABILITY:**

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

7). Stereoisomerism, Optical isomerism, geometrical isomerism, Tautomerism of carbonyl compounds, resolution of racemic mixture & conformational analysis.

8). General methods of preparations, Properties, identification test and Pharmaceutical application of the following classes & their analogs of alcohols, Phenols, ether, ketons, aldehydes, carboxylic acids, esters, amines, aniline, amide, imide, lactams, lactones, diazonium salts.

PHARMACEUTICAL ORGANIC CHEMISTRY -I LAB]
COURSE # PD-309 **Cr. Hr 01**

1. GLP and Introduction to Pharmaceutical Organic Chemistry Lab
2. To lab safety identify the given compound Oxalic Acid
3. To identify the given compound: Benzoic Acid
4. To identify the given compound : Salicylic Acid
5. To identify the given compound : Resorcinol
6. To identify the given compound : Urea
7. To identify the given compound : Thiourea
8. To identify the given compound : Benzamide
9. To identify the given compound : Citric Acid
10. To identify the given compound : Glucose
11. To identify the given compound : Thymol.
12. To identify the given compound : Fructose
13. To identify the given compound : Sucrose
14. To identify the given compound : Sulphanilic acid
15. To identify the given compound : 1-Naphthol

PHARMACEUTICAL BIOCHEMISTRY-I [TH]
COURSE # PD-311 **Cr. Hr. 03**

1. **General Introduction and Basic Biochemical Principles**
   1.1. Role of pharmaceutical Biochemistry in the health Professional
   1.2. Nature of Biochemical reactions

2. **Basic Chemistry of Biomolecules** (Nature, Classification etc.) **and their Metabolic fate** (Anabolism and Catabolism)

   2.1. **Carbohydrates**:
      2.1.1. Chemistry
      2.1.2. Classification
      2.1.3. Reactions of Carbohydrates
      2.1.4. Optical activity
      2.1.5. Biological/Clinical and pharmaceutical importance of carbohydrates.
      2.1.6. Introduction to metabolism
      2.1.7. Brief introduction to the digestion and absorption of carbohydrates
      2.1.8. Glycolysis
      2.1.9. Pentose Phosphate Pathway
      2.1.10. Glycogenolysis
      2.1.11. Glycogenesis
      2.1.12. Gluconeogenesis
      2.1.13. Citric acid cycle
      2.1.14. Energetics of various metabolic processes

   2.2. **Proteins and Amino acids**:
      2.2.1. Chemistry
      2.2.2. Classification of proteins and amino acids
      2.2.3. Reactions of proteins and amino acids
      2.2.4. Organizational levels
      2.2.5. Macromolecular nature of proteins
      2.2.6. Biological/ Clinical and pharmaceutical importance of proteins and amino acids.
      2.2.7. Brief introduction to the digestion and absorption of proteins and amino acids
      2.2.8. Metabolism of essential and non-essential amino acids
      2.2.9. Biosynthesis and catabolism of Haeme and porphyrin compounds.

   1.1. **Vitamins**:
      1.1.1. Chemistry
      1.1.2. Classification (Fat-soluble and water-soluble vitamins)
      1.1.3. Biological and pharmaceutical importance of vitamins.
      1.3.4 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.

1.2. **Bioenergetics**:
    1.2.1. Principles of bioenergetics
    1.2.2. Electron transport chain and oxidative phosphorylation

PHARMACEUTICAL BIOCHEMISTRY-I [LAB]
COURSE # PD-313 Cr. Hr. 01

1. To prepare 0.9% Nacl solution
2. Detection of carbohydrates by Barfoed's test method
3. Detection of reducing sugar by Benedict's test.
4. Iodine test for carbohydrate detection
5. Seliwanoff's test.
6. Oligosaccharide detection by Molisch test method.
7. Analysis for the presence of carbohydrate by Picric acid Test.
8. Osazone test
9. Detection or identification of unknown protein by Biuret test method
10. Detection of protein through Ninhydrin test
11. Detection of hydroxy phenyl group in provided protein by Millions test
12. Detection of sulphur containing protein.
13. Precipitation of protein by heat and acetic acid method
14. Qualitative test for amino acids by Pauly's method.
15. Determination of proteins by Sakaguchi Test.

PHYSIOLOGY - I [TH]
COURSE # PD-315 **Cr. Hr. 03**

1. **BLOOD**
   - 1.1. Composition of blood (RBC, WBC and Platelets)
   - 1.2. Functions and Genesis of the formed elements
   - 1.3. Fate of Red Blood cells
   - 1.4. Jaundice
   - 1.5. Reaction of Blood
   - 1.6. Blood groups
   - 1.7. Rh factors
   - 1.8. E.S.R.
   - 1.9. Blood volume
   - 1.10. Functions of Spleen
   - 1.11. Blood coagulation and Coagulation disorders
   - 1.12. Hemophilia,. Anaemias- classification., Leukemia

2. **CIRCULATORY SYSTEM**
   - 2.1. Properties of the cardiac muscle
   - 2.2. Origin and conduction of the heart beat
   - 2.3. Cardiac cycle
   - 2.4. ECG
   - 2.5. Heart sounds
   - 2.6. Cardiac output
   - 2.7. Stroke volume and heart rate
   - 2.8. Nerve supply of the Heart
   - 2.9. Coronary, Pulmonary, and skin circulation
   - 2.10. Blood pressure,
   - 2.11. Vasomotor system.
   - 2.12. Arterial pulse.
   - 2.13. Venous pulse,
   - 2.14. Capillary circulation
   - 2.15. Axon reflex
   - 2.16. Triple response
   - 2.17. Circulatory changes in exercise
   - 2.18. Composition and circulation of lymph
   - 2.19. Hyper- and Hypotension
   - 2.20. Arteriosclerosis, Atherosclerosis
   - 2.21. Angina, MI, CHF, Arrhythmias
   - 2.22. Hemorrhage & Shock

3. **RESPIRATORY SYSTEM**
   - 3.1. Mechanics of respiration
   - 3.2. Intrathoracic, Intrapulmonary pressure
   - 3.3. Pulmonary ventilation
   - 3.4. Lungs volume and capacities
   - 3.5. Composition of Inspired Air, Expired Air and Alveolar Air

3.6. Carriage of O_2 and CO_2 by the blood
3.7. Regulation of breathing(Nervous & Chemical control)
3.8. Respiratory changes in exercise
3.9. Hypoxia, Asphyxia
3.10. Pneumonias, eh. Emphysema, Bronchial Asthma.
3.11. Oxygen Therapy and Resuscitation

4. **DIGESTIVE SYSTEM**
4.1. Mastication. Deglutition
4.2. Digestive juices-saliva, Gastric juice, pancreatic juice. Bile and, intestinal juices; their composition
4.3. Functions and mechanism of secretion
4.4. Movements of the stomach and intestines
4.5. Functions of large intestine
4.6. Defecation
4.7. Functions of liver and gall bladder.

5. **URINARY SYSTEM**

6. STRUCTURE OF KIDNEYS
6.1. Urine formation
6.2. Composition of urine
6.3. G.F.R.
6.4. Urea and creatinin Clearance
6.5. Renin Angiotensin System
6.6. Formation of concentrated and diluted urine.
6.7. Acid Base Balance

ANATOMY & HISTOLOGY-I [TH]
COURSE # PD-317 **Cr. Hr. 02**

1). **Introduction : Anatomical Terminology:**

Introduction of cell, Planes of body, Directions of body, body cavities, and body regions

2) Epithelial and connective tissue

3) **Skeletal System**

Skeleton, joints, cartilages, bones & their distribution

4) **Cardiovascular System:**

a). Heart: Structure of heart, Location of Heart, Blood supply of Heart.

b). Blood Vessels: Main Blood vessels arising & entering the heart, Types of blood vessels with example.

5). **Respiratory System:**

Name and structure of different parts of respiratory system and their inter relationship.

6). **Alimentary System:**

Name and structure of different parts of elementary system and their inter relationship.

7). **Urinary System:**

Name and structure of different parts of urinary system and their inter relationship.

FIRST PROFESSIONAL

SEMESTER SECOND:

ENGLISH-B (Communication & writing skills) Cr. Hr. 02

ENG-301

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

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

CV and job application:

Translation skills: Urdu to English.

Study skills: Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension.

Academic writing skills: Letter/memo writing, minutes of meetings, use of library and internet. How to write a proposal for research paper/term paper? (emphasis on style, content, language, form, clarity, consistency).

Presentation skills: Personality development (special emphasis on content, confidence, eye contact, style and pronunciation).

Essay writing: Descriptive, narrative, discursive, argumentative.

Technical Report writing: Pharmacy writing and oral communication.

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

FIRST PROFESSIONAL

SEMESTER-II

PHYSICAL PHARMACY- II (TH)
COURSE # PD-302 **CR.HR. 03.**

1). MICROMERITICS:- Particle size and shapes, distribution of particles, methods of determination of particle size and importance of particle size in pharmacy.

2). DISPERSED SYSTEM:

a). Colloids: Types, methods of preparation, properties (optical, kinetic, electrical) Dialysis and artificial kidney, stability of colloids, protection and sensitization phenomenon and applications of colloid in pharmacy.

b). Emulsions: Types, theories of emulsification, Emulsifying agents, their classification and stability of emulsion.

c). Suspensions: Types, methods of preparation, properties, suspending agents, their classification and stability.

3). RHEOLOGY:

a). Definitions and fundamental concept.

b). Properties contributing to rheological behaviors.

c). Graphical presentation of rheological data.

4. EXTRACTION PROCESSES:

a. Maceration: Purpose & process.

b. Percolation: Purpose and Process.

c. Liquid-Liquid extraction: Purpose and Process.

d. Large scale extraction: Purpose and Process.

5). KINETICS: RATE AND ORDER OF REACTIONS KINETIC PRINCIPLES AND STABILITY TESTING THEORETIC CONSIDERATION: Degradation:

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

b). Chemical Factor: Complex chemical reaction oxidation-reduction, hydrolysis.

PHYSICAL PHARMACY-II [LAB]
COURSE # PD-304 **Cr. Hr. 01**

NOTE: Practicals of the subject shall be designed from time to time on the basis of theoretical topics and availability of the facilities e.g., Solubility and factors affecting solubility, Stock solution and serial dilution, Isotonic, hypotonic and hypertonic solution, Buffer solution, Angle of repose, Compressibility index, Particle size distribution by sieving method, Distillation and its types, density and specific gravity determination, Viscosity and factors affecting viscosity, Surface tension and factors affecting surface tension, Flocculation and deflocculation of suspensions, Identification tests for emulsions etc.

RECOMMENDED BOOKS:

1). Martin, Physical Pharmacy, B.I Waverty Pvt, Dehli 4th Ed. 1994.

2). Cooper and Gunn's Tutorial Pharmacy, CBS Publishers & Distributors, New Dehli, 1986.

3). Bentley's, Pharmaceutics, All India Traveler Book Seller, New Dehli 1996.

4). Martin. P. Bustamante, P and Chun, Physical & Clinical Principal's of Pharmaceutical Science, A.H.C 4th Edition (1999), New York.

5). Martin A. M. N. Banker G.S. and Chun A.H.C Advance in Pharmaceutical Sciences. Academic Press London. 1985.

6). Mill C.C. Casson N Reology of disperses system, Pergamon Press, New Dehli, 1975.

7). Rienger M and Scott-Blair. G. W Reology Academic Press London 1972.

8). Barry B. W. Advances in Pharmaceutical Sciences, Academic Press, London. 1990.

9). Sherman P. Emulsion Sciences, Academic Press, London 1972.

10). Martine A. Swarbrick J. and Cammatra A. Physical Pharmacy 3rd Ed. Lee & Febiger, Philadelphia. 1983.

11). Attwood D. and Florence A. T. Surfactant System Chapman and I tall Ltd. London, 1982.

12). Remington's Pharmaceutical Sciences, Mack Publisher Company USA, 2001.

PHARMACEUTICAL ORGANIC CHEMISTRY-II [TH]
COURSE # PD-306 **Cr. Hr. 03**

1. **Stereochemistry:** Stereoisomerism, optical isomerism, Molecules with more than one chiral centre. Geometrical isomerism, Resolution of racemic mixture. Conformational analysis.

2. **Preparation and properties of medicinally important heterocyclic compounds such as:** Pyrrol, Furan. Thiophene, Pyridine, Pyrimidine, and Pyrazine.

3. **Preparation and properties of heterocyclic Compound in which Benzo-ring is fused:** With five and six membered ring containing one heteroatom: Iodole. Quinoline and Isoquinoline.

4. **Elements**
   Periodic classification of elements, general aspects and group properties of each specific class of elements.

5. **Essential and Trace Elements**
   To study the role of essential and trace elements in biological systems and their toxicity

6. **Inorganic Drugs**
   Occurance, preparation, physical characteristics, chemical properties, purity test, incompatibilities , assay and pharmaceutical uses of inorganic drugs such as:

Aluminum Hydroxide	Ammonium chloride
Sodium carbonate	Sodium chloride
Sodium thiossulphate	Sodium tetraboarate (borax)
Magnesium carbonate	Potassium chloride
Lithium carbonate	Sodium nitrate
Calcium gluconate	Calcium carbonate
Calcium chloride	Calcium lactate
Ferrous Fumarate	Ferrous sulfate
Ferrous gluconate	Iron polysaccharide
Silver nitrate	Antimony gluconate
Iodine	Hydrogen per oxide
Boric acid	Zinc oxide

7. **FREE RADICALS:**

Introduction, structure, properties, preparation & stability.

PHARMACEUTICAL ORGANIC CHEMISTRY-II [LAB]
COURSE # PD- 308 **Cr. Hr. 01**

1. To prepare 1N hydrochloric acid solution and check the normality.
2. To standardize 0.1N sodium hydroxide solution with sulphuric acid solution of 0.1N normality.
3. To prepare 1N sodium carbonate solution and check the normality.
4. To prepare 0.5N sodium hydroxide solution and check the normality
5. To standardize 0.05N potassium Permagnate solution with Oxalic acid solution of 0.05 N normality.
6. Assay of Oxalic acid
7. Assay of Hydrochloric acid by official method.
8. Assay of Benzoic acid by official method.
9. Assay of Sulphuric Acid by official method.
10. Assay of sodium hydroxide by official method
11. Assay of Sodium bicarbonate by official method.
12. To prepare Naphthalene Picrate.
13. To Prepare Iodoform.
14. To Prepare Urea nitrate.
15. To prepare Biuret
16. To prepare urea oxalate

PHARMACEUTICAL BIOCHEMISTRY-II [TH]
COURSE # PD-310 **Cr. Hrs. 3**

2.3. **Lipids**:
- 2.3.1. Brief introduction to the digestion and absorption of lipids
- 2.3.2. Oxidation of fatty acids through β-oxidation
- 2.3.3. Biosynthesis of fatty acids, neutral lipids and cholesterol.
- 2.3.4. Chemistry of Fatty acids and Lipids
- 2.3.5. Classification (Saponifiable and non-saponifiable lipids, Simple, Complex and derived lipids)
- 2.3.6. Reactions of Fatty acids and other Lipids
- 2.3.7. Essential fatty acids
- 2.3.8. Biological/ Clinical and pharmaceutical importance of lipids.

1.3. **Nucleic acids**
- 1.3.1. Chemistry
- 1.3.2. Types (DNA, RNA, mRNA, tRNA, rRNA)
- 1.3.3. Purine and Pyrimidine bases
- 1.3.4. Nuceiosides
- 1.3.5. Nucelotides
- 1.3.6. Structures of nucleic acids, Biological and pharmaceutical importance of nucleic acids.

1.4. **Hormones**:
- 1.4.1. Chemistry
- 1.4.2. Classification (Proteinous and non-proteinous hormones, amino acid derivatives, steroids)
- 1.4.3. Biological and pharmaceutical importance of hormones.
- 1.4.4 Receptor mediated regulation of Hormones:
  - 1.4.4.1 Mechanism of action of hormones
  - 1.4.4.2 Physiological roles of various hormones
  - 1.4.4.3 Site of synthesis and target sites of hormones.

1.5. **Enzymes**:
- 1.5.1.1. Chemistry
- 1.5.1.2. Classification
- 1.5.1.3. Mode of action
- 1.5.1.4. Kinetics (Michaelis-Menten Equation and some modifications)
- 1.5.1.5. Inhibition
- 1.5.1.6. Activation
- 1.5.1.7. Specificity
- 1.5.1.8. Allosteric enzymes
- 1.5.1.9. Factors affecting the rate of an enzyme catalyzed reaction
- 1.5.1.10. Biological and pharmaceutical importance
- 1.5.1.11. Mechanism of action of some important enzymes (Chymotrypsin, Ribonuclease).

1.6. **Secondary Messengers**:

1.6.1. Role of cAMP, Calcium ions and phosphoinositol in the regulation of metabolic processes.

1.7. **Gene Expression**:

1.7.1. Replication. Transcription and Translation (Gene expression)

1.7.2. Introduction to Biotechnology and Genetic Engineering

1.7.3. Basic principles of Recombinant DNA technology

1.7.4. Pharmaceutical applications

1.8. Acid-Base and Electrolyte Balance in Human body.

PHARMACEUTICAL BIOCHEMISTRY-II [LAB]
COURSE # PD-312 **Cr. Hrs. 1**

1. Determine the acid value of fats and oils.
2. Saponification test for Lipids
3. Determination of Saponification value of fats and oils
4. Detection of Cholesterol by Salkowski's Method.
5. Qualitative test for the presence of fatty acids by titrimetric method.
6. Test for unsaturation of fatty acids in lipid sample.
7. Detection of ketone bodies by Nitroprusside method
8. To demonstrate the process of Emulsification in lipids.
9. Analysis for the generation of ammonia in urea.
10. Analysis of urea by Hypobromite Test.
11. Estimation of creatinine by Jaffe's Method.
12. Determination of uric acid by phosphotungstic acid reduction test.
13. Determination of Uric acid by phosphomolybdic reagent
14. Analysis for the reaction of Urea by Urease Test.
15. Analysis of the action of Saliva.
16. Normal constituents of urine
17. Abnormal constituents of urine

PHYSIOLOGY - II [TH]
COURSE # PD-314 **Cr. Hrs. 3**

1. **PHYSIOLOGY OF NERVE AND MUSCLE**
   1.1. Chemical change in Muscle on contraction
   1.2. Action Potential

2. **NERVOUS SYSTEM**
   2.1. Spinal reflexes
   2.2. Reflex regulation of movement and posture
   2.3. Cerebral cortex functions
   2.4. Voluntary movements
   2.5. Descending tracts of spinal cord, Basal ganglia, Cerebellum
   2.6. Cranial Nerves
   2.7. Autonomic Nervous system
   2.8. Thalamus
   2.9. C.S.F.

3. **SKIN**
   3.1. Structure
   3.2. Functions of skin
   3.3. Temperature regulation by Skin.

4. **SPECIAL SENSE**
   4.1. Elementary knowledge of structure and function of the special senses.

5 **ENDOCRINOLOGY**
   5.1 Definition of Hormone
   6.8. Nature of different types of hormone
   6.9. Mechanism of action of hormone.
      6.9.1. **Pituitary hormones**
         6.9.1.1. Growth Hormone
         6.9.1.2. Prolactin
         6.9.1.3. ACTH
         6.9.1.4. TSH
         6.9.1.5. ADH
         6.9.1.6. Oxytocin
         6.9.1.7. Acromegaly, Giantism, PanHypopituitrism.
      6.9.2. **Thyriod Gland**
         6.9.2.1. Thyroxin
         6.9.2.2. Tri-iodothyronin
         6.9.2.3. Format and functions of thyroid hormones
         6.9.2.4. Hyperthyroidism. Myxocdene.
      6.9.3. Parathyroid Hormone
      6.9.4. Pancreatic Hormone
         6.9.4.1. Insulin
         6.9.4.2. Glucagon
         6.9.4.3. Diabetes mellitus.

6.9.5. **Adrenal Glands**

- 6.9.5.1. Mineralocorticoids
- 6.9.5.2. Glucocorticoids
- 6.9.5.3. Anabolic Steroids
- 6.9.5.4. Adrenalin, Nor-adrenalin
- 6.9.5.5. Cushing syndrome, Addison disease.

6.9.6. **Sex Hormones**

- 6.9.6.1. Male Sex Hormone, structure and function
- 6.9.6.2. Female Sex Hormone: Structure and function
- 6.9.6.3. Male Development of secondary sex characteristics
- 6.9.6.4. Spermatogenesis
- 6.9.6.5. Composition of semen
- 6.9.6.6. Female Development of secondary characters
- 6.9.6.7. Menstruation, (Ovarian cycle).
- 6.9.6.8. Oogenesis. (Dysmanorrhea, etc.)
- 6.9.6.9. Pregnancy, maintenance and parturition
- 6.9.6.10. Contraceptive devices

PHYSIOLOGY [LAB]
COURSE # PD-316 **Cr. Hrs. 2**

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

Physiology:

1). Introduction to experimental Physiology

2) Blood:

Determination of Hemoglobin (Hb),

Hemoglobin content of blood.

E.S.R,

R.B.C. Count,

W.B.C. Count,

D.L.C. (Differential Leukocyte Count).

Bleeding time,

Coagulation time

Determination of blood groups.

Blood sugar level

3). Respiration:

Estimation of vital capacity and its relation to posture and standard vital capacity

Determination of tidal volume.

Demonstration of artificial respiration.

Breath holding time

4). C.V.S:

Recording of Arterial Pulse.

Recording of Arterial Blood Pressure and electro – cardiogram.

Effect of drugs on frog's heart.

Cardiac efficiency test

Cardiopulmonary resuscitation.

5). EYE:

Visual activity,

far vision, near vision

field of vision.

6). Nerve & muscle preparation:

Nerve muscle preparation in frog effect of temperature on muscle. Demonstration of special reflexes.

ANATOMY & HISTOLOGY – II (Theory)
COURSE # PD- 318 **Cr. Hr. 02.**

1) Muscle and nervous tissue

2) Integument system

Including Skin, Glands, hair, & nail.

3) Endocrine System:

a). Pituitary gland, structure and relation to hypothalamus.

b). Thyroid gland, structure.

c). Adrenal gland, structure.

04). Nervous System:

Introduction: Cells of Nervous System (Neuron). Accessory cells of N.S Organization of Nervous System.

a). Central Nervous System: Brain – Meninges (Cerebrum – cerebral lobes, Ventricles, Cerebellum – Anatomy of Cerebellum, Brain Stem – Mid Brain, Pons, Medulla, Oblongata, Diencephalons, Thalamus, Hypothalamus, Cranial Nervous, Spinal Cord – Meninges. C.S.F. Internal structure. Sensory and Motor Pathway. Spinal Reflexes Peripheral spinal nerves)

b). Autonomic Nervous System:

Sympathetic Nervous system and Parasympathetic Nervous system.

05) Reproductive System:

Male and Female reproductive system. Name, structure and association of the organs.

ANATOMY & HISTOLOGY [Lab]
COURSE # PD-320 **CR. HR. 01.**

1) **Demonstration of preparation and staining of slides. Histological examination of slides**:

2). **Basic Tissues:** Epithelium, (Classification, shape, distribution and function). Supporting / connective tissue including bones and cartilage. (Classification, Distribution and Function) Muscular Tissue. (Types, distribution and function Nervous Tissue (Neuron and its types Neuralgia-classification and distribution).

3). **Gastrointestinal tract:** G.I.T including exocrine organs: Liver, pancreas and Gall Bladder.

4). **Respiratory system:** Respiratory system including Nasal cavity, Larynx Trachea, Lung.

5). **Cardio Vascular System:** Heart, Artery, and Vein.

6). **Skin:** Type of skin, Derivatives of skin including Nail, sebaceous glands, sweat glands and Hair follicles.

7). **Lymphoid Tissue:** General structure of lymphoid organs lymph node, Spleen, palatine tonsil and thymus.

8). **Excretory System including kidney:** Ureter and Urinary bladder.

9). **Reproductive System:** Male reproductive organs. (Testes, Genital Tract). Female reproductive organs. (Ovary and female genital tract).

10). **Endocrine System:** Pituitary gland, Adrenal gland. Thyroid gland, Parathyroid gland,

11). **Bones and Joints**

SECOND PROFESSIONAL

SEMESTER - III:

ISLAMIC STUDIEES ISL-400 **Cr. Hr. 2**

PHARMACEUTICAL MICROBIOLOGY & IMMUNOLOGY-I [TH]
COURSE # PD-401 **Cr. Hr. 03**

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

1). GENERAL MICROBIOLOGY:

Historical Introduction, Contribution of different scientists, Scope of Microbiology with special reference to Pharmaceutical Sciences, Types of Microorganisms, taxonomy, nomenclature.

2). THE BACTERIA: General and cellular Morphology, Structure and function. Growth curve, Growth characteristics, Nutrition Requirements and Nutrition factors affecting growth. Culture media, Bacteria culture and staining methods.

3) THE VIRUSES: Introduction, Classification, Cultivation and replication.

4). THE FUNGI / YEAST / MOLDS:

Introduction, structure of fungal cell, medical significance of fungi, growth of fungi, reproduction in fungi, some diseases caused by fungi (Cutaneous mycoses, sub cutaneous mycoses, systemic mycoses, candidiasis, mycotoxicosis.)

5). THE PROTOZOA: Introduction and classification of protozoa, Diseases caused by protozoa: Scabies, Amebiasis, Malaria, Toxoplasmosis

6). NORMAL FLORA Of HUMAN BODY: Microbiology of air, water and soil (general introduction and normal inhibitants of air, water and soil).

7). HOSPITAL ACQUIRED INFECTIONS: A brief introduction of the microorganisms involved in nosocomial infections.

8). INTRODUCTION TO IMMUNOLOGY: Immunity, Types of immunity: Specific and non-specific (Cellular basis of immune response). Antigen, parts of antigen, properties of antigen, microbial antigen, Antibodies: structure of antibodies, functions of antibodies, classes of antibodies.

PHARMACEUTICAL MICROBIOLOGY AND IMMUNOLOGY-I [Lab]
COURSE PD-403 Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Preparation of general and selective media and culturing of micro organism. Total and viable counts of micro organism. Morphological and selective biochemical characterization of some specimen. Staining of bacteria. Gram method, Acid fast staining, Capsule staining, Flagella staining and spore staining.

RECOMMENDED BOOKS:

1). Jawetz Medical Microbiology and Immunology, 5th Ed. Churchill Livingstone, London, 1998.

2). W. B. Hugo & A. D. Russell, Pharmaceutical Microbiology, Black Well Science Ltd. London 6th Ed.1998.

3). Lippincott, Microbiology by Lippincott, William & Willkin, USA,2001.

4). Alcamo, Introduction to Microbiology, John Bartlett Publisher, 6th Ed.2003.

5).Collin and Lynes. Microbiological Methods, Vutterworth Heineman, Oxford 1995.

6). Singleton and Sainsbury, Dictionary of Microbiology and Molecular Biology. John Wiley & sons, New York. 2000.

7). M. Mekallec, Microbiology. Essential and Application Mac Graw Hill. Inc, 2nd Ed.

8). Pelczar. Microbiology, MacGraw Hill . Inc,1996.

9). Perscott, Harley, Microbiology Second, Klein Wm. C. Brown Publisher. 2001

10). An introduction to Microbiology, Tortora, funkee, case, 9th Edition.

PHARMACEUTICAL PREPARATION AND DOSAGE FORM SCIENCE- I [TH]

PD-405 **Cr. Hr. 03**

1). **INTRODUCTION:** Dosage Form Ingredients.

2). **PHARMACEUTICAL CALCULATIONS:** Some Fundamentals of Measurements and Calculations (Weights and measure).The metric System. Common System. Reducing and enlarging formulas.

3). **GALENICAL- PREPARATION:** Infusion Decoction, Extracts, Fluid extract., Tinctures, Aromatic Waters.

4). **SOLVENTS USED IN PHARMACEUTICAL PREPARATIONS.**

5). **ORAL SOLUTIONS, SYRUPS, ELIXIRS AND SPIRITS:** Solutions and preparation, dry mixtures for solution, oral rehydration solutions, oral colonic lewage solution. Syrup: components and preparation of Syrups. Elixirs. Preparation of elixirs, medicated and non-medicated elixirs.

6). **ORAL SUSPENSIONS, EMULSIONS, MAGMA AND GELS:** Preparation, Examples and Importance.

7). **TOPICAL DRUG DELIVERY SYSTEM:** Introduction of ointment, Creams, pastes, Poultice, Plasters, Lotions, liniments, Topical gels, Topical Tinctures, Collodions, Topical solutions, Topical Powders.

PHARMACEUTICAL BIOSTATISTICS [TH]

COURSE # PD- 407 **Cr. Hr. 03**

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:

Variables. Quantitative and qualitative variables. Univariate Data. Bivariate Data. Random Variables. Frequency Table, Diagrams, Pictograms, Simple Bar Charts, Multiple Bar Charts, Histograms.

3). SUNNARIZING 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 of High degree Curve.

5). PROBABILITY:

Definitions, Probability, Rules .Probability , Distributions (Binomial & Normal Distributions).

6). SIMPLE REGRESSION AND COORELATION:

Introduction, Simple linear Regression Model correlation co-efficient.

7). TEST OF HYPOTHESISAND SIGNEFICANCE

Statistical Hypothesis. Level of significance . Test of Significance. Confidence Intervals, Test involving Binomial and Normal Distributions.

8). STUDENT "T". "F" AND CHI-SQUARE DISTRIBUTION:

Test of Significance based on "t", "F" and Square Distributions.

9). ANALYSIS OF VARIANCE:

One – way classification, Two way Classification. Partitioning of sum of Squares and Degree of Freedom, Multiple compression test such as LSD. The analysis of variance Modles.

RECOMMENDED BOOKS:

1). Daniel W. W. Bio Statistics, Foundation for Analysis in Health Sciences. 3rd Edition,1983.
2). Zar. J. H. Bio-Statistical analysis, Francis Hall, N. J. USA.
3). Nilton, J. S. and Tsokes, J.D. Statistical Methods in Biological and Health Sciences, Me. Grew-Hill,1983.
4). Chaudhry SA. And Kamal S. Introduction to Statistical Theory. Part-I and Part-II, Ilmi Kitab Khana, Urdu Bazar Lahore, 1996.
5). Sunmels M. Statistics for the life sciences, Dellen Pub. Co. SF. USA, 1991.
6). Walpole RF. Introduction to Statistics, Macmillam Pub.Co. NY.1982.

PHARMACOLOGY & THERAPEUTICS-I [TH]
COURSE # PD-409 **CR. HR. 03**

1. General Pharmacology

. 1.1. **Introduction** (History, Pharmacology and its classification, Drugs and their sources).

1.1.Pharmacodynamics

1.1.1. Receptors
- 1.1.1.1.Receptor theories
- 1.1.1.2.Agonists, Antagonists & Partial Agonists
- 1.1.1.3.Summation, Potentiation and Antagonism
- 1.1.1.4.Types of Antagonism
  - 1.1.1.4.1. Competitive Antagonism
  - 1.1.1.4.2. Non-competitive Antagonism
  - 1.1.1.4.3. Chemical Antagonism
  - 1.1.1.4.4. Physiological Antagonism
  - 1.1.1.4.5. Pharmacological Antagonism

1.1.2. Mechanisms of drug action
1.1.3. Signal transduction mechanisms
1.1.4. Factors modifying the drug response.
1.1.5. Anaphylaxis & tolerance
1.1.6. Therapeutic Index
1.1.7. Toxic drug reactions (Cumulation, Carcinogenicity, Mutagenicity, Teratogenicity)
1.1.8. Adverse Drug Reactions and Side effects

1.2.Pharmacokinetics

1.3.1. Routes of drugs administration.
- 1.2.1.1. The merits and demerits of routes of administartion.
- 1.2.1.2. The factors influencing the choice of routes of administration

1.2.2. Passage of drug molecules across the cell membranes (Simple diffusion, Carrier mediated diffusion, Carrier mediated exchange diffusion, Active Transport, Phagocytosis, Pinocytosis)
1.2.3. The drug absorption from GIT and other routes into blood and various factors capable to influence the rate and extent of the absorption
1.2.4. Drug binding to plasma and tissue proteins.
1.2.5. The distribution of drugs to the tissues and factors capable to modify the rate and extent of the distribution.
1.2.6. Metabolism of the drugs and factors capable of influencing metabolism
- 1.2.6.1. Phase-1 & Phase-11 reactions
- 1.2.6.2. Routes of Drug Excretion (Excretion through Kidney, Excretion through GIT, Excretion through Lungs, Excretion through Skin & Hairs, Drug Excretion in Milk & its significance)

1.2.7. Definitions and Explanation of the following terms;
- 1.2.7.1.Bioavailability & Bioequivalence.
- 1.2.7.2.biotransformation
- 1.2.7.3.Plasma Half Life ($t_{1/2}$)
- 1.2.7.4.Dose-Response Curve
- 1.2.7.5.Area Under Curve

1.2.7.6. Volume of Distribution
1.2.7.7. Loading dose, maintenance dose
1.2.7.8. Adjusted/corrected doses

2. Drugs Acting On Autonomic Nervous System (ANS)

2.1. Organization of ANS its subdivisions and innervations.
2.2. Neurotransmitters in ANS, their synthesis, release and fate.
2.3. Parasympathetic agonists
  2.3.1. Cholinergic Agonist
  2.3.2. Cholinestrase inhibitors
2.4. Parasympathetic antagonists
2.5. Drugs acting on Ganglia
  2.5.1. Ganglion stimulants
  2.5.2. Ganglion blockers
2.6. Neuromuscular blocking drugs
2.7. Sympathetic agonist drugs.
  2.7.1. Catecholamines
  2.7.2. Non-catecholamines
  2.7.3. Sympathetic antagonist drugs (Adrenoceptor antagonists).
    2.7.3.1. Alpha-adrenergic blockers (α_1 & α_2)
    2.7.3.2. Beta-adrenergic blockers (β_1 & β_2)
    2.7.3.3. Mixed adrenergic blockers

3. AUTACOIDS AND DRUGS WITH IMPORTANT ACTION ON SMOOTH MUSCLES

3.1 Histamine, Serotonin & the Ergot Alkaloids
3.2 Vasoactive Peptides
3.2 The Eicosanoids: Prostaglandins, Thromboxanes, Leukotrienes, & Related Compounds
3.4 Nitric Oxide

RECOMMENDED BOOKS

1. Bertram G. Katzung. Basic and Clinical Pharmacology 12th edition.
2. Casarett and Doull's Toxicology: The basic science of Poisoning
3. Charles Craig. Modern Pharmacology with Clinical Applications.
4. Goodman and Gillman's ; The Pharmacological Basis of Therapeutics
5. James Ritter. A text Book of Clinical Pharmacology and Therapeutics

PHARMACOLOGY & THERAPEUTICS-I [Lab]
COURSE # PD-411 **CR. HR. 01.**

Practicals 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. Purposes of Pharmacological Experiments
2. Research Methods and Experimental Techniques
3. Development of Experimental Designs
4. To demonstrate the Experimental Animals Handling Procedures
5. To study different Routes of Administration of drugs in animals; their onset, duration of action with their merits and demerits.
6. To prepare the solutions of drug materials and calculations of Doses of Drugs for different Animals.
7. To prepare different standard solution: Ringer-Locke solution, Krebs-Henseleit solution, Tyrode solution, Normal saline solution.
8. To study Biostastistical methods and Related terminologies with examples of pharmacological applications of Student's t- test.
9. To study the effects of sympathomimetic drug (Adrenaline) on Rabbit's Eyes.
10. To study the effects of sympatholytic drugs (Propranolol) on Rabbit's Eyes.
11. To study the effects of parasympathomimetic drug (Pilocarpine) on Rabbit's Eyes.
12. To study the effects of parasympatholytic drug (Atropine) drugs on Rabbit' eye**.**
13. To identify the unknown drug & differentiate its effects on Rabbit's eyes.
14. To demonstrate the effects of sympathomimetic (Adrenaline) & sympatholytic drugs (Propranolol) on Frog's heart.
15. To demonstrate the effects of parasympathomimetic (Acetylcholine) and parasympatholytic (Atropine) drugs on Frog's heart.
16. To demonstrate the effects of an unknown drug on Frog's heart.

ISLAMIC STUDIES
COURSE # ISL-400 **CR. HR. 02**

GENERAL PHARMACOGNOSY [TH]

COURSE # PD- 413 **Cr. Hr. 03**

1. **INTRODUCTION TO PHARMACOGNOSY:**
   Definition, History, Scope, Traditional systems of Medicine and Herbal practice.

2. **CRUDE DRUGS:**
   i. Definition, Classification of Crude Drugs
   (Alphabetical, Taxonomical, Morphological, Chemical and Therapeutic classification).

   ii. Terminology Used in Pharmacognosy.
   iii. Preparation of Crude Drugs for Commercial Market.
   (Methods of Cultivation, Collection, Harvesting, Drying, Packaging, Storage, Preservation,).
   iv. Deterioration and Adulteration of Crude Drugs.
   v. Evaluation of Crude Drugs i.e., Organoleptic, Microscopic. Physical, Chemical and Biological.

3. **THE STUDY OF THE CRUDE DRUGS BELONGING TO VARIOUS FAMILIES OF MEDICINAL IMPROTANCE:**

FAMILIES:	**CRUDE DRUGS:**
a). Ranunculaceae	*Aconitum, Larkspur, Pulsatilla, Hydrastis.*
b). Papaveraceae	*Papaver somniferum*, *Sanguinariacanadensis.*
c). Leguminosae	*Acacia, Glycyrrhiza, Senna, Cassia. Tamarind.*
d). Umbelliferae	*Fennel, Coriander, Conium, Asafoetida.*
e). Apocynaceae	*Rauwolfia, Catharanthus.*
f). Solanaceae.	*Belladonna, Hyoscyamus, Stramonium, Capsicum.*
g). Scrophulariaceae.	*Digitals purpurea, Verbascum (Mullien).*
h). Labiatae	*Peppermint, Thyme, Spearmint.*
i). Liliaceae.	*Garlic, Colchicum, Aloe.*
j). Zingiberaceae	*Ginger, Curcuma.*

4. **DRUGS OF ANIMAL ORIGIN:**
   Introduction, Classification, Chemistry, Functions and uses of following drugs of Animal origin: Honey, Gelatin, Shellac, Musk, Civet, Ambergris, Cod liver oil, Cantharides and Spermaceti in detail.

5. **SURGICAL DRESSINGS**

   A. Definition, classification and functions of surgical dressings.

   B. Introduction, Sources, Structure, Preparation, Description and Uses and tests for surgical Fibers and Sutures as given in B.P.C

6. **BIOLOGICS**

   A. Definition, classification and origin of antibodies, immunity and its classification.

   B. Introduction, Sources, Structure, Preparation, Description and Uses of following:

      i. Vaccines,

ii. Toxins,

iii. Diagnostic antigens

iv. Antitoxins

v. Venoms and Antivenins

vi. Antiserums.

PHARMACOGNOSY-I [LAB]
COURSE # PD- 415 **Cr. Hr. 01**

Macro and organoleptic characters of the drugs.----- 30 drugs
Microscopic evaluation of Crude Drugs

- Transverse Sections ---- 10 Drugs
- Powder Drugs ---------- 10 Drugs

SEMESTER IV:

PAKISTAN STUDIES COURSE#PKS-401 **Cr. Hr. 03**

PHARMACEUTICAL MICROBIOLOGY & IMMUNOLOGY-II [TH]
COURSE # PD-402 **Cr. Hr. 03**

Note: The topic will be taught with special reference to Pharmaceutical Applications.

1). INDUSTRIAL MICROBIOLOGY:

a) Introduction to Sterilization / Disinfection, Preservatives

b) Fermentation and respiration, ranges of fermentation, parameters of fermentation, production of pharmacologically active fermentation products, selection of suitable medium, isolation and recovery, kinetics of microbial growth, continuous culture application in fermentation.

2). FACTORY AND HOSPITAL HYGIENE AND GOOD MANUFACTURING PRACTICE: Introduction, control of microbial contamination during manufacture, manufacture of sterile products

3). INFECTIONS CAUSED BY DIFFERENT BACTERIAL SPECIES: *Staphylococcus aureus, E.coli, Salmonella, Vibrio cholera, Mycobacterium tuberculosis, Helicobacter pylori, Clostridium botulinum, Clostridium tetani, Pneumococcal pneumoniae, Bacillus anthracis, Shigella dysentry, Corynebacterium diphtheria.*

4). INFECTIONS CAUSED BY VIRUSES: Hepatitis, Rabies virus, Adenovirus, Rhinovirus , Influenza virus (influenza), Varicella (Chicken pox), Mumps virus, Polio virus, Rotavirus (Gastroenteritis), Flavivirus

5). IMMUNOLOGY: Antigen antibody reactions and their clinical and diagnostic applications. Hypersensitivity and allergy, types of hypersensitivity,Drug allergy mechanism, autoimmune diseases.

6). BIOLOGICALS: Vaccination, Introduction and aims, types of vaccines, current vaccine practices, production of vaccine and antisera.

7). ANTIBIOTICS: Definition, classification, mode of action, antimicrobial spectrum, side

effects.

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

PHARMACEUTICAL MICROBIOLOGY AND IMMUNOLOGY-II [Lab]
COURSE # PD-404 **Cr. Hr. 01**

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e. g. Sterilization of Glassware and Pharmaceutical Products by various methods, Microbiological analysis of air, water and soil. Microbiological assay of Antibiotics.

RECOMMENDED BOOKS:

1). Jawetz Medical Microbiology and Immunology, 5th Ed. Churchill Livingstone, London, 1998.

2). W. B. Hugo & A. D. Russell, Pharmaceutical Microbiology, Black Well Science Ltd. London 6th Ed.1998.

3). Lippincott, Microbiology by Lippincott, William & Wilkin, USA,2001 Ed

4). Alcamo, Introduction to Microbiology, John Bartlett Publisher, 6th Ed.2003.

5). Collin and Lynes. Microbiological Methods, Vutterworth Heineman, Oxford 1995.

6). Singleton and Sainsbury, Dictionary of Microbiology and Molecular Biology. John Wiley & sons, New York. 2000.

7). M. Mekallec, Microbiology. Essential and Application Mac Graw Hill. Inc, 2nd Ed.

8). Pelczar. Microbiology, McGraw Hill. Inc, 1996

9).Prescott, Harley, Microbiology Second, Klein Wm. C. Brown Publisher. 2001.

10). An introduction to Microbiology, Tortora, funke, Case, 9th Edition.

PHARMACEUTICAL PREPARATION AND DOSAGE FORM SCIENCE -II [TH]
COURSE # PD-406 Cr. Hr. 03

1). OPHTHALMIC, NASAL AND OTIC PREPARATIONS:

Ophthalmic solutions, suspension, ointment, inserts, contact lens solution. Nasal decongestant solutions, Decongestant inhalers, Ear preparations, Anti-infective, anti-inflammatory and analgesic.

2). SUPPOSITORIES AND VAGINAL SUPPOSITORIES:

Semi-solid preparations, Suppositories bases, preparation, Packaging, and storage, solution / Enemas.

3). AEROSOLS, INHALATIONS AND SPRAYS:

Aerosol, Principle, container and valve assembly, Propellants, filling testing, packaging, labeling, and storage.

4). POWDER, CAPSULES, TABLET DOSAGE FORMS:

Preparation of powder, mixing of powders, uses and packaging of powders, granules effervescent. granules. Granulated salts, hard gelatin capsules, capsule sizes, preparation of filled hard gelatin capsules, soft gelatin capsules, preparation and its application. Tablets, their types characteristics and methods of preparation.

5). INTRODUCTION TO PARENTERALS:

Official types of injections, solvents, and vehicles for injections, added substances.

PHARMACEUTICAL PREPARATION AND DOSAGE FORM SCIENCE [Lab]
COURSE # PD-408 Cr. Hr. 02

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. Preparation of aromatic water, salicylic acid lotion, calamine lotion, ferrous sulphate oral solution, chalk mixture, starch mucilage, iodine paint, iodine tincture, bentonite magma, ORS powder, soft soap enema, ear drops, glycerites, poultice of kaolin, effervescent granules, etc.

RECOMMENDED BOOKS:

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

2). Bentley's Book of Pharmaceutics. CBS Publisher & Distributors, New Dehli, 1998.

3). Pharmaceutics, 2nd Edition. Haw Court Publisher, 2002.

4). E. A. Rawlins, Berdley's Textbook of Pharmaceutics. Edited by 8th Ed 1977. Macmillan publishing Co. Inc. New York.

5). Sprawl's American Pharmacy. Dittert LW, 7th ed., JB. Lippincott co. 1999.

PHARMACOLOGY & THERAPEUTICS-II [TH]
COURSE # PD-410

CR. HR. 03

1. DRUGS ACTING ON CARDIOVASCULAR SYSTEM

1.1. Anti hypertensives
1.2. Diuretics
1.3. Angina pectoris and Myocardial Infarction and their drug treatment
1.4. Congestive heart failure & its treatment.
1.5. Antiarrhythmic drugs
  1.5.1. Class IA
  1.5.2. Class IB
  1.5.3. Class 1C

2. DRUGS ACTING ON BLOOD

2.1. Agents used in Hyperlipidemia
2.2. Drugs Used in Disorders of Coagulation
2.3. Agents Used in Anemias; Hematopoetic growth factors

3. DRUGS ACTING ON GASTROINTESTINAL TRACT

3.1. Emesis and Antiemetics
3.2. Purgatives
  3.2.1. Bulk forming purgatives
  3.2.2. Lubricant purgatives
  3.2.3. Irritant purgatives
3.3. Antidiarrheal Agents.
3.4. Treatment of Peptic & Duodenal Ulcers
  3.4.1. Antacids
  3.4.2. H_2-Receptor Antagonists
  3.4.3. Antimuscarinic Agents
  3.4.4. Proton Pump Inhibitors
  3.4.5. Gastrin Receptor Antagonist
  3.4.6. Cytoprotective agents.
3.5. Drug treatment of chronic inflammatory diseases of bowel.
3.6. Drugs affecting bile flow and Cholelithiasis.

4. DRUGS USED IN INFLAMMATORY DISORDERS:

3.1 Nonsteroidal , Anti-Inflammatory Drugs (NSAID)
3.2 Disease-Modifying Antirheumatic Drugs (DMARDS)
3.3 Nonopioid Analgesics
3.4 Drugs Used in Gout

RECOMMENDED BOOKS

1. Bertram G. Katzung. Basic and Clinical Pharmacology 12th edition.
2. Casarett and Doull's Toxicology: The basic science of Poisoning
3. Charles Craig. Modern Pharmacology with Clinical Applications.
4. Goodman and Gillman's ; The Pharmacological Basis of Therapeutics
5. James Ritter. A text Book of Clinical Pharmacology and Therapeutics

PHARMACOLOGY & THERAPEUTICS-II [Lab]

COURSE # PD-412 **CR. HR. 01**

1. To demonstrate the effects of stimulant drugs on Rabbit's intestine (Acetylcholine, Barium chloride).

2. To demonstrate the effects of depressant drugs on Rabbit's intestine (Atropine).

3. To differentiate the effects of an unknown drug on Rabbit's intestine and identify the (unknown) drug.

4. To demonstrate the effects of Acetylcholine on the Rectus abdominus muscle of frog and competitive pharmacological antagonism by Neuromuscular blocking agent e.g., Gallamine.
5. To identify the unknown drug by performing pharmacological competitive antagonism on Rectus abdominus muscle of Frog.
6. To study the anti-coagulant effects of Heparin and oral anti-coagulants on Rabbits.
7. To observe the Analgesic activity of Aspirin by Writhing test in animals.
8. To observe the Analgesic activity of Unknown drug by Writhing test in animals.
9. To observe the Anti-nociceptive activity of NSAID (Aspirin) by formaline induced pain in mice
10. To observe the Anti-inflammatory activity of NSAID (Aspirin) by formaline induced edema in mice
11. To observe the Anti-inflammatory activity of NSAID (Aspirin) by carrageenin induced edema in mice.
12. To observe the diuretic effects of furosemide and thiazide in mice
13. To observe the diuretic effects of Carbonic anhydrase inhibitors in mice
14. To observe the diuretic effects of K^+ Sparing diuretics in mice

PATHOLOGY-I [TH]
COURSE # PD-414 **CR. HR. 02**

1. SCOPE OF PATHOLOGY & CONCEPT OF DISEASES

2. DEFINITION AND TERMINOLOGIES

2.1. Ischemia
2.2. Hypoxia
2.3. Necrosis
2.4. Infarction
2.5. Atrophy
2.6. Hypertrophy
2.7. Hyperplasia
2.8. Metaplasia
2.9. Aplasia
2.10. Anaplasia

3. ACUTE AND CHRONIC INFLAMMATION

4. TISSUE INJURY, RENEWAL, REGENERATION AND REPAIR

5. DISEASES OF IMMUNE SYSTEM

5.1. Autoimmune disorders
- 5.1.1. Systemic lupus erythematosus
- 5.1.2. Rheumatoid arthritis
- 5.1.3. Sjogren's syndrome
- 5.1.4. Systemic sclerosis
- 5.1.5. Imflammatory myopathies
- 5.1.6. Polyarteritis nodosa and other vasculitides

5.2. Rejection of tissue transplant
5.3. Immuno deficiency syndromes
- 5.3.1. Primary immunodeficiencies
- 5.3.2. Secondary immunodeficiencies
- 5.3.3. Acquired immunodeficiency syndrome (AIDS)

6. DISEASES OF THE GASTROINTESTINAL SYSTEM

6.1. Esophagitis
6.2. Gastritis
6.3. Ulcerative disorders
6.4. Hernias
6.5. Diarrhea and constipation
6.6. Irritable bowel syndrome
6.7. Appendicitis
6.8. Hemorrhoids
6.9. Cholilithiasis

RECOMMENDED BOOKS:

1). Kumar Cortan Robin, Basic Pathology 6th edition W. B. Saunders, Company Philadelphia (1992).

2). Walters and Israel, General Pathology, Churchill Livingstone, London (1998).

3). Peter S. Macfarlane, Robin Reid, Robin Collander, Pathology Illustrated, Churchill Livingstone, London (1998).

4). Robins Pathology, W.B. Saunbders Co, London, 2nd Edition, 1962.

5).Walter G. B. General Pathology, Churchill Livingstone, New York. 1996.

CHEMICAL PHARMACOGNOSY[TH]
COURSE # PD- 416 **Cr. Hr. 03**

1. CARBOHYDRATES:
Introduction, Biosynthesis, Properties, Classification, Functions, Chemical tests.

A) **Sucrose and sucrose containing drugs:**
Sucrose, Dextrose, Liquid glucose, Fructose, Lactose, Xylose, Caramel, Honey, Starch, Inulin, Dextran

B) Drugs Containing Compounds metabolically related to Sugars
Cherry juice, Acids, Alcohol

C) **Cellulose and Cellulose Derivatives:**
Purified Cotton, Powdered cellulose, Cellulose Derivatives, (Microcrystalline cellulose, Ethyl cellulose, Methyl cellulose, Sodium carbonyl Methyl cellulose etc.)

C) **Gums and Mucilages:**
Tragacanth, Acacia, Karaya, Ghatti, Guar, Locust bean, Xanthum, Sodium alginate, Agar, Cararageenan, Plantago seeds, Pectin

2. **ALKALOIDS:**

Introduction, properties, Classification, Biosynthesis and Function of Alkaloids in plants, Methods of extraction and identification tests.

a) Pyridine: Piperidine Alkaloids:*Areca nut, Lobelia. Tobacco.*

b) Tropane: Alkaloids: *Balladonna***,** *Hyoscyamus***,** *Stramonium.*

c) Quinoline Alkaloids: *Cinchona*.

d) Isoquinoline Alkaloids: *Ipecacuanha, Opium.*

e) Indole Alkaloids: *Rauwolfia, Catharanthus, Nux vomica, physostigma, ergot.*

f) Imidazole Alkaloids:*Pilocarpus.*

g) Steroidal Alkaloids: *Veratrum.*

h) Alkaloidal amines: *Ephedra, Colchicum.*

i) Purine Bases: *Tea, Coffee.*

3. GLYCOSIDES:

Introduction, Classification, Chemistry and Medicinal uses of:

a) Cardioactive Glycosides: *Digitalis, Strophanthus and White Squill.*

b) Anthraquinone Glycosides: *Cascara, Aloe, Rhubarb, Cochineal and Senna.*

c) Saponin Glycosides: *Glycyrrhiza, Sarsaparilla.*

d) Cyanophore Glycosides: *Wild cherry.*

e) **Isothiocyanate Glycosides:** *Black Mustard.*

f) **Lactone Glycosides:** *Cantharide.*

g) **Aldehyde Glycosides:** *Vanilla.*

h) **Miscellaneous Glycosides:** *Gentian, Quassia, Dioscorea.*

4. STEROIDS:

Introduction, Extraction, isolation, nomenclature, Classification according to their constitution and functions, biosynthesis of various steroids through cholesterol biosynthesis, commercial production of natural steroids, chemical structures and medicinal uses of:

1. Bile acids,
2. Plant sterols,
3. Cardiac glycosides,
4. Steroidal sapogenins,
5. Steroid hormones.: Introduction, Historical background, Commercial production, Extraction and Isolation) Animal Hormones: Adrenal glands, Thyroid glands, Pituitary, Parathyroid, and Pancreas, etc. Plant hormones: Auxins, Gibberellin, Cytokinins and Abscisic acid.

a) Adrenal Cortex

i. Cortisol/Hydro cortisol
ii. Deoxy corticosterone

b) Gonads

i. Testes
ii. Testosterone

c) Ovary

i. Estrogens
ii. Estradiol
iii. Estrone
iv. Corpus luteum/progestin
v. Progesterone

PHARMACOGNOSY-II [LAB]
PD- 418 **Cr. Hr. 01**

- Macro and Organoleptic characters of the drugs.----- 30 drugs
- **Phytochemical examination of Natural products**
- **Surgical Dressings**

THIRD PROFESSIONAL

SEMESTER-V

PHARMACOLOGY & THERAPEUTICS-III [TH]
COURSE # PD-501 **CR. HR. 03**

1. DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

1.1 Introduction to the pharmacology of CNS Drugs
1.2 Sedatives- Hypnotics Drugs
1.3 The Alcohols
1.4 Antiseizure Drugs
1.5 General Anesthetics
1.6 Local Anesthetics
1.7 Skeletal Muscle Relaxants
1.8 Pharmacologic Management of Parkinsonism and other movement disorders
1.9 Antipsychotic Agents and Lithium
1.10 Antidepressant Agents
1.11 Opioid Agonists and Antagonists
1.12 Drugs of Abuse

2 HORMONES, ANTAGONISTS AND OTHER AGENTS AFFECTING ENDOCRINE FUNCTION

2.1 Hypothalamic and pituitory hormones
2.2 Thyroid and antithyroid drugs
2.3 Adrenocorticosteroids and adrenocortical antagonists
glucocorticoids
mineralocorticoids (Aldosterone, fludrocortisone)
2.4 The Gonadal hormones and inhibitors (the estrogen, progestins, other ovarian hormones, oral contraceptives, inhibitors and antagonists and ovulation inducing agents).
2.5 Pancreatic hormones and Antidiabetic drugs (insulins, oral hypoglycemics)
2.6 Agents that affect bone mineral homeostasis

3. DRUGS ACTING ON RESPIRATORY SYSTEM

3.1 Drugs used for cough

a. Antitussives
b. Expectorants
c. Mucolytic Agents

3.2 Drug used for Bronchial Asthma

a. Bronchodilators
b. Prophylactic agents
c. Corticosteroids & other Anti-inflammatory drugs-
d. Muscarinic receptor antagonists (Ipratropium)

3.2 Chronic Obstructive Pulmonary Diseases (COPD)

RECOMMENDED BOOKS

1. Bertram G. Katzung. Basic and Clinical Pharmacology 14th edition.
2. Casarett and Doull's Toxicology: The basic science of Poisoning
3. Charles Craig. Modern Pharmacology with Clinical Applications.
4. Goodman and Gillman's ; The Pharmacological Basis of Therapeutics
5. James Ritter. A text Book of Clinical Pharmacology and Therapeutics

PHARMACOLOGY & THERAPEUTICS-III [Lab]
COURSE # PD-503 **CR. HR. 01**

Practicals 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. To study the Sedative activity of Diazepam in Mice by open field method.
2. To study the Sedative activity of Drug in Mice by Light and Dark Field method.
3. To study the effects of Diazepam on Exploratory Activity by Head Dip method in mice.
4. To study the Antidepressant activity of Laxotanil in Mice by Swimming induced stress method.
5. To study the convulsant effects of strychnine or picrotoxin in frogs and to determine the site of action.
6. To study the convulsant effects of strychnine or picrotoxin in mice and to determine the site of action.
7. To study the Anti-convulsant effects of Phenytoin or Valproic acid in mice and to determine the site of action.
8. To identify the unknown (convulsant) drug and determine its site of action.
9. To study the effects of local anaesthetic drugs on the nerve plexus of frog.
10. To observe the General anesthetic effect of Chloroform / Ethanol by Inhalation method in rats.
11. To observe the effect of drug in treatment of Haloperidol induced catalepsy in mice.
12. To observe the effect of Sinemet in Haloperidol induced catalepsy in mice.
13. To observe the effects of Spinal Anesthesia in Rats.
14. To observe hyperglycemic effects of streptozotacine in rabbits.
15. To determine the Glibenclamide hypoglycemic activity of drug in rabbits.

PATHOLOGY-II [TH]
COURSE # PD-505 **CR. HR. 02**

1. **DISEASES OF THE CARDIOVASCULAR SYSTEM BLOOD**
   A. Vascular Diseases
   1. Hypertensive Vascular Disease
   2. Arteriosclerosis and Atherosclerosis
   3. Aneurysms
   4. Vasculitis

   B. Heart

   5. Heart failure (CHF)
   6. Ischemic heart disease
   7. Arrhythmias
   8. Angina
   9. Myocardial infarction

2. **DISEASES OF THE CARDIOVASCULAR SYSTEM BLOOD**
   10. Anemia
   11. Bleeding disorders

3. DISEASES OF CENTRAL NERVOUS SYSTEM

12. Cerebral Edema

Malformation and Development Diseases

13. Neural Tube Defects.
14. Fore brain anomalies.
15. Posterior fossa anomalies
16. Perinatal Brain injury.
17. Epilepsy
18. Trauma.
19. Intracranial Hemorrhage

Degenerative Diseases

20. Alzheimer Disease
21. Parkinson Disease
22. Huntigton's Disease

4. DISEASES OF THE RESPIRATORY TRACT

23. Pulmonary edema

Obstructive pulmonary diseases

24. Asthma
25. Bronchitis
26. Emphysema
27. Bronchiectasis

Disorders affecting pleura

28. Pleural effusion

29. Pneumothorax

5. INFECTIOUS DISEASES

30. Introduction to common bacterial, viral, fungal and protozoan infections
31. Cholera
32. Typhoid
33. Tuberculosis
34. Viral hepatitis
35. Meningitis
36. Measles and mumps
37. Polio
38. Whooping cough
39. Leprosy
40. Malaria
41. Infective endocarditis
42. Pneumonia
43. Candidiasis
44. Urinary tract infections
45. Skin infections

6. NEOPLASIA

46. Leukemia
47. Blood Cancer
48. Malignant Carcinomas
49. Sarcoma & Lymphomas
50. Diagnosis and treatment of Cancer in general, fate survival and prognosis with tumors.

RECOMMENDED BOOKS:

1). Kumar Cortan Robin, Basic Pathology 6th edition W. B. Saunders, Company Philadelphia (1992).
2). Walters and Israel, General Pathology, Churchill Livingstone, London (1998).
3). Peter S. Macfarlane, Robin Reid, Robin Collander, Pathology Illustrated, Churchill Livingstone, London (1998).
4). Robins Pathology, W.B. Saunbders Co, London, 2nd Edition, 1962.
5). Walter G. B. General Pathology, Churchill Livingstone, New York. 1996.

PATHOLOGY [Lab]
COURSE # PD-507 **CR. HR. 01.**

1. Study of Pathological Slides of various Pathological Conditions

1.1. Acute Inflammation
1.2. Chronic inflammation
1.3. Chronic specific inflammation
1.4. Different types of Degeneration
1.5. Thrombosis
1.6. Embolism
1.7. Infarction
1.8. Necrosis
1.9. Gangrene
1.10. Hyperplasia
1.11. Metaplasia
1.12. Pigmentation
1.13. Calcification
1.14. C.V.C.
1.15. Papiloma
1.16. Adenoma
1.17. Chondroma
1.18. Fibroma
1.19. Leomyoma
1.20. Neofibroma
1.21. Sq. Cell Carcinoma
1.22. Basal Cell Carcinoma
1.23. Transitional Cell Carcinoma
1.24. Adenocarcinoma
1.25. Fibrocarcinoma
1.26. Rhadomyosarcoma
1.27. Leomyosarcoma
1.28. Lymphosarcoma
1.29. Liposarcoma
1.30. Reticular Cell Sarcoma
1.31. Hodgkins disease
1.32. Breast Carcinoma
1.33. Osteogenic sarcoma
1.34. Osteoclastoma

2. Examination of different body fluids in various Pathological Conditions

2.1. Urine complete Examination
2.2. Stool Examination
2.3. Blood Complete Examination
2.4. Semen Examination
2.5. Cerebrospinal Fluid Examination
2.6. Pericardial fluid examination
2.7. Pleural Fluid Examination
2.8. Ascitic Fluid Examination
2.9. Blood Sugar
2.10. Blood Urea
2.11. Blood Cholesterol etc

3. Tests for various Specimens of Clinical Importance

3.1. Techniques of Clinical Blood Examination for various diseases
3.2. Gastric Analysis
3.3. Tests for liver function test
3.4. Renal function test
3.5. Tests for endocrine abnormalities
3.6. Biopsies and cytologic techniques

Pharmaceutical Chemistry (Instrumentation and Analytical Chemistry)-I [TH]

COURSE # PD- 509 **Cr. Hr. 03**

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

Theory: Instrumentation and Pharmaceutical Applications of the following Spectroscopic Methods.

1). **Atomic Absorption and Emission Spectroscopy**.

- Introduction
- Theory
- Instrumentation

2). **Molecular fluorescence spectroscopy**.

- Phosphorescence and Fluorescence
- Quantum efficiency
- Radiationless deactivation
- Instrumentation

3). **Flame Photometry.**

- Instrumentation

4). **U.V. / Visible spectroscopy.**

- Introduction to spectroscopy
- Theory
- Structure Elucidation
- Instrumentation

5). **I. R. spectroscopy**

- Introduction
- Theory
- Structure Elucidation
- Instrumentation
- Spectral Studies

6). **N. M. R. spectroscopy.**

- Introduction
- Theory
- Structure Elucidation
- Instrumentation

- Spectral Studies

7). **Mass spectroscopy.**

- Introduction
- Theory
- Structure Elucidation
- Instrumentation
- Spectral Studies

Pharmaceutical Chemistry (Instrumentation and Analytical Chemistry)-I [LAB]

COURSE # PD- 511 **Cr. Hr. 01**

1. To observe the working of calorimeter using given solution of $KMno_4$.
2. To study Beer's Law using calorimeter.
3. Determine the concentration of unknown sample using colorimeter by applying formula.
4. Determine the concentration of unknown sample using colorimeter by graphical method.
5. To use pH meter and perform its caliberation.
6. To prepare solution of given buffer tablet and check pH.
7. To prepare acetate buffer.
8. To prepare solution of Na_2Co_3 and $NaHCo_3$ and check pH.
9. To Observe the change in pH upon addition of small quantity of NaoH solution from graph.
10. To determine the λmax of given compounds by using UV visible spectrophometer.
11. Study the beer's Law by using UV-Visible spectrophometer.
12. Determination of Linear regressing by using UV-Visible spectrophotometer.

ADVANCE PHARMACOGNOSY-I [TH]
COURSE # PD- 513 **Cr. Hr. 03**

1. ESSENTIAL OILS

Introduction, biosynthetic pathways, Significance, therapeutic effects and uses, methods of obtaining Volatile oils,physical and Chemical properties, and Classification according to various groups:

a) Hydrocarbon Volatile oils: Cubeb and Turpentine.

b) Alcoholic Volatile oils: Peppermint, Coriander and Cardamom.

c) Aldehydic Volatile oils: Bitter Orange peel, sweet Orange peel, Lemon, Cinnamon and bitter Almond oil.

d) Ketonic Volatile oils: Camphor, Spearmint, Caraway, Buchu.

e) Phenolic Volatile oils: Clove, Thyme.

f) Phenolic Ether Volatile oils: Fennel, Anise, Myristica.

g) Oxide Volatile oils: Eucalyptus, Chenopodium.

h) Ester Volatile oils: Rosemary.

i) MiscellaneousVolatile oils: Allium, Anethum.

2. RESINS AND RESIN COMBINATION

Introduction, Properties and classification and discuss following:

a) Resins: Rosin, Cannabis.

b) Glycoresins: Podophyllum, Jalap, Ipomoea, Colocynth.

c) Oleoresins: Turpentine, Capsicum, Ginger.

d) Oleo-gum Resins: Asafoetida, Myrrh.

e) Balsams: Styrax, Peruvian balsam, Tolu balsam, Benzoin.

3 TANNINS

Introduction Classification, Properties and Chemical identity tests of Tannins and Tannins containing compounds. Detailed study of Hammamelis, Catechu and Nut Galls.

4 LIPIDS

Introduction, Classification, biosynthesis, Properties, Chemical Identity Tests and detailed study of:

Fixed Oils:

1. Castor Oil,
2. Cotton seed Oil,
3. Olive Oil,
4. Peanut Oil,

5. Sunflower Oil,
6. Corn Oil,
7. Coconut Oil,
8. Almond Oil,
9. Persic Oil,
10. safflower Oil,
11. Sesame Oil and
12. Soybean Oil.

Fats and Related Compounds:

1. Hydrogenated vegetable oil
2. Ethiodized oil for injection
3. Theobroma Oil
4. Lanolin
5. Anhydrous lanolin
6. Lanolic Alcohols
7. Fatty acids
8. Prostaglandin

Waxes:

1. Bees Wax,
2. Carnauba Wax,
3. Spermaceti and
4. Jojoba Oil.

5 NUTRACEUTICALS

A. Introduction, Classification, Chemistry, Role in Healthcare system, Regulatory and Market aspects of Nutraceuticals.

B. Role of following Nutraceuticals: Flavonoids (Isoflavones, Lycopene) Lignans, Lutein, Amino acids, Lecithin, Cranberry extract, Pycnogenol, Ginkgo , Garlic , Ginseng, Chlorella, Chitosan, Glucosamine, Chondroitin, Creatine, Carnitine, Royal jelly, Pro-and pre-biotics, Minerals (Fluride, Zinc, Potassium , Calcium and Selenium).

6 COSMECEUTICALS

1) Introduction: Definition and History
2) Classificationof Cosmeceuticals, types of Cosmeceuticals and Cosmeceutical ingredients as Skin, Eye, Hair and Dental care and other Products.
3) Biological studies, Chemistry, Uses and Toxicology of Botanicals and their isolated products used in Cosmeceuticals.
4) Role of the following plants as Cosmeceuticals:
    - **Fruits and vegetables**: Pomegranate, Walnut, Cucumber, Carrot, Onion, Ginger, Amla, Reetha.

- **Spices**: Turmeric, Cinnamon, Thyme, Piper longum, *Crocus sativus*
- **Oils**: Olives, Almond, Coconut, Jojoba, Apricot kernel oil, Rosemary.
- **Flowers**: Lavender, Arnica, Chamomile, Calendula.
- **Herbs**: Tulsi, Henna, Sage, Hibiscus, Licorice, Aloe, Tea
- **Others**: Oats, Gum, Myrrh, Honey, Kelp.

7 VITAMINS

Introduction, Classification, Biosynthesis of Vitamins and discussion about Halibut oil, Cod liver oil, dried Yeast, vitamin B-Complex i.e. Thiamine, Riboflavin, Niacin and Niacinamide, Pentothenic acid, Cyanocobalamine, Folic acid, Biotin, Vitamin C, A, D, E, and K.

PHARMACOGNOSY-III [LAB]

COURSE # PD- 515 **Cr. Hr. 01**

PRACTICALS SHOULD BE DESIGNED ACCORDING TO SYLLABUS

1. Extraction of the active constituents of crude drugs and chemical tests for their identification.
2. Isolation of Chemical Constituents.
3. Preparation of Cosmeceuticals.
4. Preparation of Nutraceuticals.

COMPOUNDING & DISPENSING PHARMACY [TH]
COURSE # PD-517 **Cr. Hr. 03**

1). **BASIC PRINCIPLES OF COMPOUNDING AND DISPENSING :**

Calculation for Compounding and Dispensing, Fundamental operations in Compounding. Containers and closures for Dispensed products, Prescription. Handing (Parts of prescription, Filling, Interpretation, Pricing).Labeling of Dispensed Medication, HLB Calculation, Dose Calculation, Dilution Method and Alligation Method.

2). **EXTEMPORANEOUS DISPENSING OF:** Solutions, Suspensions, Emulsion, Creams, Ointments, Pastes and gels, Suppositories and pessaries, Powders, Granules and Oral unit dosage form.

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

4). **I. V. ADMIXTURE.**

5). **RADIO-PHARMACY:** Fundamentals, Radiopharmaceutical dosage forms, official radio pharmaceuticals; Physical nuclear pharmacy, Application of Radio Pharmacy.

6). **COSMETOLOGY :** Introduction of cosmetology , cosmetological formulations and their preservation, packaging methods and side effect of such products.

7). **ORAL HYGEINE PRODUCTS:** A brief Introduction to oral hygiene products..

8). **NUTRACEUTICALS:** Market and demand, classification and examples , effectiveness and Safety.

COMPOUNDING & DISPENSING PHARMACY [Lab]
COURSE # PD-519 **Cr. Hr. 01**

NOTE:- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e. g. Practical introduction to prescription-handing interpretation, incompatibility, dispensing of simple mixture containing soluble substances only. Mixtures containing diffusible substances, indefensible substances and mixtures forming precipitate; dispensing of simple powders, compound powders and effervescent powders for external use, dispensing of iodine and Methyl salicylate ointment.; Dispensing of cold cream and vanishing creams; cosmetological products such as Lipstick, talcum powder, aftershave lotion, shaving cream etc.

RECOMMENDED BOOKS:

1). Cooper and Gunn's, Dispensing Pharmacy, CBS publishers & Distributors, New Dehli, 1986 Ed

2). Hussa's Dispensing.

3). Remington's pharmaceutical Sciences, Mack Publishing Company, USA,2001 Ed

4). Martindale's Extra Pharmacopoeia.

THIRD PROFESSIONAL

SEMESTER-VI

PHARMACOLOGY & THERAPEUTICS- IV [TH]
COURSE # PD-502 **CR. HR. 03.**

1. Chemotherapy

1.1 Antibacterials
1.1.1 Cell Wall Synthesis Inhibitors
Penicillinins
Cephalosporins
Fist Generation Cephalosporins
Second Generation Cephalosporins
Third Generation Cephalosporins
Carbapenems
Monobactams
Miscellaneous (Vancomycin, Bacitracin, etc.)
1.1.2 β-Lactamase Inhibitors
1.1.3 Protein Snthesis Inhibitors
1.1.1.1. Tetracyclines
1.1.1.2. Aminoglycosides
1.1.1.3. Macrolides
1.1.1.4. Chloramphenicol
1.1.1.5. Clindamycin
1.1.4 Folate Antagonists
1.4.1.1 Folate Synthetase Inhibitors
1.4.1.2 Folate Reductase Inhibitors
1.1.5 Quinolones
1.2 Urinary Tract Antiseptics (Nitrofurantoin, Methenamine).
1.3 Antimycobacterial Drugs
1.3.4.1 Anti-tuberculosis Drugs
1.3.4.2 Anti-leprosy Drugs
1.4 Antiprotozoals
1.4.4 Treatment of Malaria
1.4.5 Treatment of Amebiasis
1.4.6 Treatment of Trypanosomiasis
1.4.7 Treatment of Leishmaniasis
1.4.8 Treatment of Toxaplasmosis •
1.4.9 Treatment of Giardiasis
1.5 Antiviral Drugs
1.6 Antifungals
1.7 Anthelmintics

2. IMMUNOPHARMACOLOGY

Anti-neoplastic and Immunosuppressive drugs. Pharmacology of immuno-suppressants and stimulants.

3. TOXICOLOGY

3.1) Principles of Toxicology:

a) General information Role of Pharmacist in treatment of poisoning and General management (ABC&D) of poisoning & over dosage. Poison control centre.
b) Types of toxicology
c) Classification of toxic agents and spectrum of undesired effects, mechanism of toxicity.

3.2) Heavy metal poisoning (i.e. lead, mercury, arsenic) and use of Chelating agents and their role in poisoning: Dimercaprol, Calcium disodium edetate, Penicillamine , Desferoxamine , Succimer, activated charcoal, N-acetyl cystiene.

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

4. MOLECULAR PHARMACOLOY:

4.1 Introduction to Cell signaling (e.g.PI3Kinase, JAK/STAT, MAP/ERK, TLR) .

4.2 Introduction to Proteomics, Genomics, Gene therapy, Computational Techniques and regenerative medicine (i.e. Cell culture, Stem Cell) [Brief introduction, merits, demerits and significance]

4.3 Overview of Techniques in molecular medicine (e.g. PCR, ELISA, 2D Electrophoresis, SDS-PAGE, Microarray Gene sequencing [Brief introduction, merits, demerits and significance]

RECOMMENDED BOOKS

1. Bertram G. Katzung. Basic and Clinical Pharmacology 12th edition.
2. Casarett and Doull's Toxicology: The basic science of Poisoning
3. Charles Craig. Modern Pharmacology with Clinical Applications.
4. Goodman and Gillman's ; The Pharmacological Basis of Therapeutics
5. James Ritter. A text Book of Clinical Pharmacology and Therapeutics
6. Bruce Alberts. Molecular Biology of the Cell.

PHARMACOLOGY & THERAPEUTICS - IV [Lab]
COURSE # PD-504 **CR. HR. 01.**

1. Methods used to observe the Toxic effects of drugs in mice and in rats.
2. Methods used to study antimicrobial effects of Chemotherapeutic agents.
3. Pyrogen Test
4. To observe the local toxic effects of Inhaled Drug (Formaldehyde) in mice.
5. To observe the local toxic effects of orally administered Drug (Formaldehyde) in mice.
6. To determine the LD_{50} of a drug in mice or rats .
7. To observe the hepatotoxic effects of Ethanol/ Carbon tetra chloride in mice or rats.
8. To observe the hepatotoxic effects of Paracetamol in mice or rats.
9. To oberve the Hepatoprotective effects of a drug in Carbon tetra chloride induced hepatotoxicity in mice or rats.

COMPUTER & ITS APPLICATION IN PHARMACY [TH]

COURSE # PD- 506 **Cr. Hr. 03**

1). Fundamentals basic concept of computers:

History of Data Processing, Types of Computers, Components of a Computer, Computer System and Business Computer System, Backing storage Devices, Unit of Memory, Viruses and Anti-viruses Issues.

2). System Analysis and design:

What is a system? Steps in system life cycle. Data Gathering and data analysis, designing a new system, Development and implementation of new system , Documentation.

3). Data Processing:

Data processing. The Data processing Cycle, The collection and computing of data. Manual collection of data. The main method of data input, Devices used to collect data. Data verification, Data validation, output and recording of data, Types of data processing system, Type of computer operation, Batch Processing and Real-time processing.

4). Data Communication:

Application of data communication, Components of a data communication system, Rate of data Transmission, Computer networks, Network Topology, Gateway, E-mail, / Internet concepts.

COMPUTER & ITS APPLICATION IN PHARMACY [LAB]

COURSE # PD- 508 **Cr. Hr. 01**

1). Internet and E-mail:

Internet and Microsoft internet Explorer 5, Addresses, Links and Downloading, Searching the Internet, E-mail and newsgroups, favorites, 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). Complete Statistical Package like SPSS:

4). Languages:

At least two prevailing languages will be taught.

RECOMMENDED BOOKS:

1). Elias M. system analysis, Award Galgotia Publication, New Dehli, 1989.
2). Peter Norton, Inside IBM PC Brady Computer Books New York, 1988.
3). Dennis N, MS-DOS jump Practice Hall Press, New York, 1987.
4). Peter Norton, PC-DOS Brady Computer Books, New York, 1985.

Pharmaceutical Chemistry (Instrumentation and Analytical Chemistry)-II [TH]

COURSE # PD- 510 **Cr. Hr. 03**

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

1). CHROMATOGRAOHIC METHODS:

Column Chromatography, thin layer Chromatography, Gas Liquid, Chromatography, HPLC and GC-MS

2). ELECTRO CHEMICAL METHODS:

Potentiometery, Polarography and Radiochemical Techniques, Radio Pharmaceutics.

3). DIFFERENTIAL SCANNING COLORIMETRY:

Pharmaceutical Chemistry (Instrumentation and Analytical Chemistry)-II [LAB]

PD- 512 **Cr. Hr. 01**

1. To study paper chromatography and run chromatogram of given sample.
2. To study thin layer chromatography and run chromatogram of given sample by single point method.
3. To study thin layer chromatography and run chromatogram of multiple samples provided.
4. To determine RF values of given compounds for purity by using TLC method.
5. To study column chromatography and assemble column for separation of sample.
6. To separate components of given sample using column chromatography.
7. To identify components of given sample using column chromatography.
8. To study handling and calibration of conductivity meter.
9. To determine conductivity of given sample.
10. To determine conductivity of water and interpret quality.
11. To demonstrate the techniques of Differential scanning calorimetry.
12. To analyze given sample using Differential scanning calorimetry.
13. Determine the concentration of given sample by potentiometric titration using potentiometer.
14. Determine the concentration of given sample by potentiometric titration use $\Delta pH / \Delta V$ for plotting.

ADVANCE PHARMACOGNOSY-II [TH]
COURSE # PD- 514 **Cr. Hr. 03**

1. CHROMATOGRAPHY: SEPARATION AND ISOLATION OF PLANT CONSTITUENTS

An introduction to chromatography and chromatographic technique e.g. Adsorption Chromatography and Partition of Chromatography

2. SPECTROSCOPY

- Interpretation of I.R. Spectra of Antibiotics and Glycosides.
- Interpretation of U.V Spectra of Indole Alkaloids.
- Separation and identification of Essential oils by GC-MS.

3.ALLERGENS AND ALLERGENIC PREPARATION

Introduction , Case history , Skin tests, Mechanism of allergy, Treatment of Allergy, Types of Allergens in detail:

1. Inhalant,
2. Ingestant,
3. Injectant,
4. Contactant,
5. Infectant and
6. Infestant Allergens.

4.ENZYMES
Introduction, Classification, Chemistry and Functions of Plant, Animal and Microbial Enzymes; Malt extract, Pepsin, Streptokinase, Asparaginase etc.

5. PESTICIDES
Introduction, Classification, and Method of Controlling pests.

PHARMACOGNOSY-IV [LAB]

PD- 516 **Cr. Hr. 01**

PRACTICALS SHOULD BE DESIGNED ACCORDING TO SYLLABUS

- Extraction of the active constituents of crude drugs and chemical test for their identification.
- Isolation of Chemical Constituents.
- Analysis of Vitamins and Hormones.
- Extraction of Enzyme.
- Pollen Morphology and Case history for Allergy.

COMMUNITY PHARMACY [TH]

COURSE # PD-518 Cr. Hr. 03

1). **DEFINITIONS, BACKGROUND; LAYOUT OF COMMUNITY PHARMACY AND ROLE OF COMMUNITY PHARMACIST.**

2). **PUBLIC HEALTH AND COMMUNITY PHARMACY:**Introduction, Aims and Objectives of Public Health, Early Intervention, Mortality, Morbidity. Concept of Modern Public Health. Public Education. Public Health Program, Preventive Health (EPI & CDC), Family Planning and Health Policy & National Drugs Policy. Health Promotion.

3). **FIRST AID TREATMENT:** Burns; Poisoning, Initial cardiac resuscitation, Pain management, Cuts and wounds, Insect bites, treatment for hypoglycemia.

4). **PATIENT ASSESSMENT:**

5). **MEDICAL COMPLICATION OF DRUG TAKING:** General and Socioeconomic Aspect.

6). **PATIENT PHARMACIST COMMUNICATION:** Introduction; Process of communication, Methods of communication; Barriers of communication; Tools to improve communication.

7). **PATIENT EDUCATION AND COUNCELING:** Counseling, Consulting and education. Aims of Counseling, Stages, Barriers and counseling situation.

8). **CONTROL OF DRUG ABUSE AND MISUSE:** Definitions of Related terms, classification of drug abuse / misuse; sign and symptoms of drug abuse, harms related to drug abuse and drug dependence, management of drug dependence, role of pharmacist in control of drug abuse.

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

10). **EPIDEMIOLOGY:**

Scope, Immunization, Prevention / Disinfection, Uses, Factors responsible for spread of communicable diseases , Common terms used in epidemiology, Disease transmission and control. Measurement of health outcomes Incidence, Prevalence- Descriptive epidemiology, Analytical epidemiology. Types of Epidemiological studies: Randomized control trials, cohort, case control , Cross sectional.

11) **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.

12) **PHARMACOECONOMICS:** Pharmacoeconomic modeling & interpretation.

RECOMMEDED BOOKS:

1). ROY Robertson, Management of Drug user in the Community. A Practical Handbook.

2). Remington's Pharmaceutical Sciences, Mack Publisher Company USA, 2001.

3). Martindale's Extra Pharmacopoeia.

4). Hand book of health education and community pharmacy by Ashok K Gupta Communication 2007, CBs Publication.

5). Applied Epidemiology (Introduction to public health pharmacy by B.L Levis, D. Hurd, A-Hansom, 2008, Junes and Bartlett.

6). Research Method Pharmacy Practice: Felicity smith 2005, Pharm. Practice

7). Pharmaceutical Practice by A. J. Winfield

FOURTH PROFESSIONAL

SEMESTER VII:

HOSPITAL PHARMACY-I [TH]
COURSE # PD-601 **Cr. Hr. 03**

1).INTRODUCTION:

a). Role of Pharmacist in Hospital.

b). Minimum standards for Pharmacies in Institutions / Hospitals.

c). Research in Hospital Pharmacy.

2).HOSPITAL AND ITS ORGANIZATION:

a). Classification of Hospitals.

b). Organization Pattern.

c). Administration.

d). Departmentalization: Nursing, Dietetic, Pathology, Blood Bank, Radiology and other supportive services etc.

f). Role of Pharmacy in Hospital.

g). Hospital Finance.

3). PHARMACY, ITS ORGANIZATION AND PERSONNEL:

a). Pharmacy specialist .

b). Drug Information centre.

c). Poison Control centre and Antidote Bank.

d). Pharmacy Education.

e). Determining the need of professionals and other departmental staff.

f). Professional services rendered.

4). PHARMACY AND THERAPEUTICS COMMITTEE:

Introduction, organization, functions, scope and polices of P & TC.

5). THE HOSPITAL FORMULARY:

a). General principles and guidelines to develop formulary.

b). Format of hospital formulary

c). Preparation of the formulary & role of Pharmacist in formulary making

d). Benefits and problems.

e). Keeping up to date formulary.

6). DISPENSING TO INPATIENTS

a). Methods of dispensing & SOPs

b). Unit dose dispensing.

c). Other concepts of dispensing, Satellite Pharmacy etc.

7).DISPENSING TO AMBULATORY PATIENTS.

a) Introduction

b) ASHP Standards

8). DISTRIBUTION OF CONTROLLED SUBSTANCES

a) Definitions and schdules

b) Registration requirements

c) Offenses and Penalties

d) Model set of hospital controlled substances regulations.

9).DISPENSING DURING OFF-HOURS:

a) Emergency boxes and cabinets

b) Pharmacy services.

10).SAFE USE OF MEDICATIONS IN THE HOSPITAL:

a). Medication errors.

b). Evaluation & precautions for Medication Errors.

c). Role of Pharmacists in controlling Medication Errors.

RECOMMENDED BOOKS:

1). William E. Hassan, Hospital Pharmacy, Lee & Febiger, Washington, 5th Ed, 1986.

2). N. I. Bukhari, Hospital Pharmacy, Aziz Book Depot, Lahore, Pakistan, 2000.

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

INDUSTRIAL PHARMACY-I [TH]
COURSE # PD-603 **Cr. Hr. 03**

1).MASS TRANSFER

- Ways of Mass Transfer in different medium.
- Pharmaceutical application of Mass Transfer.

2).HEAT TRANSFER

- Modes of heat transfer
- Pharmaceutical application of Heat Transfer.
- Numerical of conduction.

3).DRYING: Theories of drying of solids, Classification of Dryers. General Methods: Fluidized bed system, Pneumatics System dryer, Freeze drying.

4).MIXING: Fundamentals, Mechanisms of Mixing, equipment used in Liquid / Liquid. Liquid / Solid and solid / solid mixing, Comminution (size reduction). Reasons for size reduction, factors affecting size reduction, size analysis, sieving. Energy Mills (Ball Mill, End Runner, Edge Runner, Disintegrate, Colloid Mill, Hammer Mill, Cutter Mill and Fluid Energy Mill etc).

5)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).

6).CLARIFICATION AND FILTRATION: Theory, Filter media, Filter aids, Filter selection and equipment (Leaf filter, filter press, Meta 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, Heckle plot, Consolidation, Granulation, Friability, Compression (dry method, wet method, slugging), Physics of Tabletting, Tabletting machines and other equipments required, problems involved in tabletting, tablet coating, Capsulation(Hard and soft gelatin capsule).

9).PLANT LAYOUT AND SAFETY METHODS FOR PHARMACEUTICAL INDUSTRY:

a).Mechanical, Chemical and Fire hazards.
b).Inflammable gases and dusts.

INDUSTRIAL PHARMACY-I [Lab]
COURSE # PD-605 **Cr. Hr. 01**

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

RECOMMENDED BOOK:

1).Lachman, Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Bombay, 1987.

2).Cooper and Gunn's, Tutorial Pharmacy, CBS Publishers & Distributors, New Dehli, 1986.

3).Bentley's Pharmaceutical Text Book, CBS Publishers & Distributors, New Dehli, 1986.

4).Remington's Pharmaceutical Sciences, Mack Publishing Company, USA, 2001.

5).John Sharp, Good Pharmaceutical Manufacturing Practice, Rational and Compliance.

PHARMACEUTICAL QUALITY MANAGEMENT-I [TH]
COURSE # PD-607 **Cr. Hr. 03**

1. INTRODUCTION:

a). An understanding of the testing quality control program and methods adopted in a Pharmaceutical industry, dosage from control, process, testing program and methods, physical, chemical and biological tests and specifications, statistical quality control.

b). General understanding of total Quality assurance and measures to adopt Quality Assurance.

2. PHARMACEUTICAL VALIDATION:

Introduction, types of validation, Importance of validation.

3. QUALITY CONTROL OF SOLID DOSAGE FORMS:

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

Chemical Test: Content uniformity, Assay of active ingredients and dissolution tests of Granules, Tablets and Capsules.

4. EVALUATION OF SUSTAINED ACTION PRODUCTS (TABLETS & CAPSULES):

Stability of viability rate during storage and in-vitro & in-vitro evaluation of sustaining action.

5. QUALITY CONTROL OF SUPPOSITORIES:

Disintegration test, Uniformity of weight, Assay of active ingredients, Liquefaction time and Breaking test.

6. QUALITY CONTROL OF SYRUPS AND ELIXIRS: and DISPERSE SYSTEM:

Viscosity, its determination and application in the quality control of Pharmaceuticals, Weight per ml and Assay of active ingredients.

7. **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.

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

PHARMACEUTICAL QUALITY MANAGEMENT-I [Lab]
COURSE #PD-609 **Cr. Hr. 01**

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e. g. Physical and chemical testing of solid dosage forms such as tablets, capsules, assay of finished dosage forms such as spirits, tinctures, extracts, syrups and elixirs, assay of suppositories, Assay of Tablets and capsules etc.

RECOMMENDED BOOKS:

1). A. H. Beckett and J. B. Stennlake, Practical Pharmaceutical Chemistry, Part-I and II. The Alton Press, London.

2). A. M. Kneval and F. E Digangi, Jenkin's, Quantitative Pharmaceutical Chemistry, Mac Graw-Hill, Book Company, New York.

3). K. A. Connor's, A text book of Pharmaceutical Analysis John – Wiley and Sons, New York.

4). A. Braithwaite and F. J. Smith, Chromatographic Methods, Chapman and Hall, London.

5). G. D. Christian, Analytical Chemistry, John Wiley and Sons, New York.

6). Karami A. Javaid, Pharmaceutical Quality Assurance in Class, Industry and Market, Aziz Publishers, Lahore, Pakistan (1993).

7). Gil Bismuth and Shosh Neumann, Cleaning Validation, A Practical approach, CRC, Press LLC, USA, 2003.

8). J. T. Carstersen and C. T. Rhodes, Drug Stability: Principles and Practices, 3rd Edition (received and expanded) Mercel Decker, New York, 2000.

9). Sydney H. Willige, Good Manufacturing Practices for Pharmaceuticals. Marcel Dekker Publishing.

10). Braun RE, Introduction to Instrumental Analysis, Mc Graw-Hill Book Co, NY, 1987.

CLINICAL PHARMACY-I [TH]
COURSE # PD-611 **CR. HR.03**

1. GENERAL INTRODUCTION TO CLINICAL PHARMACY:

Introduction to clinical pharmacy and related terms, definition, basic components, comparison with other clinical fields, scope of services with respect to hospital and community.
Guidelines (General guidelines for Clinical Pharmacy Practice)
Terminology of Disease Management and Treatment drug Selection.

2.PATIENT PROFILE:

a). Patient disease profile.

b). Taking case History.

c)Patient counseling compliance

3. INTERPRETATION OF CINICAL LABORATORY DATA

- Laboratory tests commonly encountered in public health surveillance.
- Laboratory test reports and practice report interpretation using specific examples.
- Common Lab Tests and Reference Ranges related to Haematology, Microbiology, Biochemistry, Immunology, Histopathology, Cytopathology

4. FLUID AND ELECTROLYTES MANAGEMENT

Basic fluid and electrolytes abnormalities in critically ill patients, types of fluids used for fluid replacement in different disease states, causes of electrolytes abnormalities.

5. DRUG INTERACTIONS:

Mechanism, Physiological factors affecting interaction, Types and level of drug interaction, Role of Pharmacist in evaluation drug interactions & its management.

6. PHARMACOVIGILANCE:

a. Scope, definition and aims of Pharmacovigilance
b. Adverse drug Reaction and side effects. Classification, Excessive Pharmacological response, Idiosyncrasy, Secondary Pharmacological effects. Allergic drug reactions, General toxicity, Toxicity following drug withdrawal, Detection, Management of ADR, Reporting of ADR in light of international health monitoring system.

7. DRUG PROFILES

Drug Profiles of following:

a. Drugs acting on CNS: (Antiepileptics, Benzodiazepines, Morphine / Pethedine)

b. Drug acting on CVS: (Adrenaline, Dopamine, Digoxin, Dobutamine, Frusemide, Nifedipine,)
c. Drug acting on respiratory tract: (Salbutamol, Atropine, Chlorpheniramine, Anti TB drugs,)
d. Drug acting on GIT: (Lactulose, ORS, Cimetidine, Metoclopramide)
e. Antibiotics (Amino glycosides, Pencillins, Cephalosporin, Fluroquinolone, Macrolides, Vancomycin)
f. Steroidal and non Steroidal anti inflammatory drugs: (NSAIDS, Prednisolone)

8. DRUGS IN PREGNANCY

9. DRUGS IN PEDIATRICS

10. DRUGS IN GERIATRICS

11. PHARMACOLOGY OF NUTRIENTS

12. PHARMACOGENETICS

CLINICAL PHARMACY-I [LAB]
COURSE # PD-613 **CR. HR.01**

1. CLINICAL PHARMACOGNOSY TH]

PD- 615 **Cr. Hr. 3**

1. INTRODUCTION TO CLINICAL PHARMACOGNOSY

General introduction to Clinical Pharmacognosy, Historical background.

Systemic Study of Herbal Medicines and their interactions:

A. Liver, Biliary system and Exocrine Pancreas

i. Hepatitis: *Silybum marianum*
ii. Jaundice:*Berberis vulgaris, Andrographis paniculata*

B. Cardiovascular System
i. Hypertension:*Crataegus spp., Viscum album, Allium sativum*
ii. Angina:*Ammi visnaga*

C. Respiratory System
i. Cold & Flu: *Echinacea, Elder,* Ginger, Cinnamon
ii. Sore Throat: Licorice, Thyme, Rosemary, Eye bright, Chickweed, Bilberry
iii. Asthma: *Marshmallow, Black cohosh, Ephedra sinica,* Passion flower.

D. Musculo-skeletal System
i. Arthritis:Black cohosh, Rosemary
ii. Gout:*Devil's claw, Bilberry, Colchicum*

E. Skin
i. Psoriasis:*Psoralea corylifolia, Burdock root*
ii. Acne:*Tea tree oil, Jojoba oil*
iii. Burns and Wounds:*Aloe vera, Honey, Calendula officinalis*

F. Central and Peripheral Nervous System

i. Migraine:*Feverfew, Ginger*
ii. Parkinson's Disease: *Atropa belladonna,Mucun apruriens*
iii. Depression:*St. John's Wort, Rosehip, Lavendar*
iv. Anxiety: *Chamomile, Lemon balm*

G. Renal System
i. Kidney stones:*bilberry, nettle, Rubia tincture*, *Rumex crispus*.
ii. Renal failure:*Uvaursi, urticaurens, sambucus nigra*

H. Reproductive System
i. Prostate problem:*Vitex,*Plantain, Saw Palmetto
ii. Breast benign disorders: *Evening primrose,* Wild yam, Marigold

iii. Menstrual problems:
    a. Dandelion, Milk thistle
    b. Burdock, Ginger, Rosemary
    c. Fennel, Elder, Nettle
    d. Chamomile, Rosemary, Meadowsweet, Sage, Lime flower.
iv. Impotence: *Ginseng,* Wild oats, Parsley.

I. Gastrointestinal System

i. Dyspepsia and Peptic Ulcers: *Fennel, Ginger, Anise and Glycyrrhiza glabra, Slippery elm*
ii. Diarrhea:*Psyllium seeds, Ceratonia siliqua*
iii. Constipation:*Cascara sagrada, Aegle marmelos*, *Ficus carica*

2. PLANT TOXICOLOGY WITH REFERENCE TO POISONUS PLANTS OF PAKISTAN.

A) HIGHER PLANT TOXINS

- Introduction & Classification of Poisonous Plants: Toxic mechanism, source, toxic part, clinical findings and management of drugs.

- Toxins from Abrus, Aconite, Nux-vomica,, Castor, Aloe, Podophyllum, Ephedra, Opium, Eucalyptus, Tobacco, Cannabis, Digitalis, Datura: description of plant, Pharmacognostic features, Pharmacological actions, Chemical constituents, Side-effects, Contra-indications, Warnings, Treatment, Prevention and Control methods

B) LOWER PLANT TOXINS: Bacterial Toxins (*Staphylococcus aureous, Clostridium botulinum*), Algal toxins (*Microcystisaerouginosa blue green algae, Conyaulaxcantenella*).

C) MYCOTOXINS: Fungal Toxins (*Aspergillusspp.,Clavicepspurpurea*, Mushrooms (*Amanita spp.*)

3. ANTICANCEROUS AGENTS FROM NATURAL SOURCES:

Carharanthusroseus(Vincristine, Vinblastine),Colchicum autumnale (Irinotecan and Topotecan, Podophyllum peltatum (Etoposide and Teniposide), Rifamycin antibiotics, Macrolide antibiotics etc.

MEDICINAL CHEMISTRY-I [TH]
PD- 617 **Cr. Hr. 02**

1. Introduction to medicinal chemistry.
2. Classification of drugs on the basis of sources, structure , site of action and mode of action.
3. Preparation and properties of medicinally important heterocylic compounds such as : Pyrrol , furan, thiophene, pyridine, pyrimidine and pyrazine.
4. Preparation and properties of heterocyclic compounds in which benzo-ring fused with five and six membered ring containing one heteroatom; indole, quinoline and isoquionoline.
5. Drug designing:
   Discovery of lead structure (different approaches)
   Structural feature of drugs
   Drug receptor interaction
   Physico chemical properties of drugs.
6. Drug metabolism inactive metabolites, biologically active metabolites, chemically reactive metabolites, phase I and Phase II reactions.
7. Structure activity relationship
8. General properties, chemistry, biological action, structure activity relationship and therapeutics applications of the following: Alicyclic compounds: Cyclopropane, terpenes, citral , piene, camphor , menthol, carotenes.
9. **Analgesic and Antipyretics**
   Paracetamol, salicylic acid analogues, quinolines derivatives pyrazolone and pyrazolodiens, N-arylanthranilic acids, aryl and heteroaryl acetic acid derivatives.

10. To study the biosynthesis, drug designing and action of the following:
    Autocoids such as prostaglandins, leukotrenes and eicosanoids

11. Vitamins (water and fat soluble): B1 , B2 , B6, B12 , folic acid, nico-tinic acid, biotin, pantothenic acid, ascorbic acid. A, D, E and K.

12. Hormones (Steroidal and proteinious): Testosterone, progesterone, estrogen, aldosteron, cortisol, insulin , glucagons, oxytocin and vasopressin.

FOURTH PROFESSIONAL

SEMESTER VIII:

HOSPITAL PHARMACY-II [TH]
COURSE # PD-602 **Cr. Hr. 03**

1).MANUFACTURING BULK AND STERILE.

2).PHARMACY CENTRAL AND STERILES SUPPLY ROOM.

3).ASEPTIC DISPENSING.

A) TPN,
B) I/V Admixtures,
C)Cytotoxic Dispensing,
D) Semi-sterile Dispensing (Eye drops, Ear Drops),
E) Hyperalimentation.

4).ROLE OF PHARMACISTS IN SMALL HOSPITALS, NURSING HOMES etc.

a) Functions of Pharmacists in Extended care facilities

b) Standards for Extended care facilities.

5).PURSHASING, DISTRIBUTION AND CONTROL OF HOSPITAL MEDICINES, MEDICAL & SURGICAL SUPPLIES.

a) Purchasing,
b) Stocking and stock control,
c) Inventory Management and control.
d) Drug Distribution.
e) Relationship between purchasing, Distribution and Clinical Pharmacy Services.
f) Procurement procedure
g) Control on purchases

6).NUCLEAR PHARMACY.

a) Radiopharmaceutical

b) Therapeutics application

c) Basic requirement and planning

d) Role of Pharmacists.

7).THE PHYSICAL PLANT AND ITS EQUIPMENT.

a) Planning of physical plant.

b) Location, floor space, cleanup area, non sterile area.

c) Temperature controlled storage.

d) Equipment selection criteria and other utilities.

8).INVESTIGATIONAL USE OF DRUGS.

a) Trial protocol

b) Guidelines

c) Pharmacists role and controlled system.

9).HEALTH ACCESSORIES.

a) Classification

b) Equipment and fitting

c) Diagnostics and first aid.

10).SURGICAL SUPPLIES.

a) Dressing and bandages.

b) supplies and sutures.

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

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

13) Antibiotic Stewardship

RECOMMENDED BOOKS:

1). William E. Hassan, Hospital Pharmacy, Lee & Febiger, Washington, 5th Ed, 1986.

2). N. I. Bukhari, Hospital Pharmacy, Aziz Book Depot, Lahore, Pakistan, 2000.

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

INDUSTRIAL PHARMACY-II [TH]

COURSE # PD-604 **Cr. Hr. 03**

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

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

3) SEMISOLIDS: Equipment used in making of Ointments, Pastes, Gels and Jellies and their Packaging.

4) STERILE PRODUCTS: Sterile area and its Classification, Ophthalmic ointments, Preparation of Parentrals (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, antioxidants, solubilizer, suspending agents, buffers, stabilizers etc). In process Quality Control of parentrals (Sterility, Leakage, Pyrogens, Clarity etc).

5) STANDARDIZATION OF PHARMACEUTICALS: An understanding of quality assurance system adopted in Pharmaceutical industry, Good Manufacturing Practices and Current Good Manufacturing Practices.

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

7) EQUIPMENTS USED FOR: Patches, Sprays, Implants. Sutures, Plasters and Sachet packing.

8).STUDY TOUR: A visit to the Pharmaceutical industries will be an integral part of the syllabi

INDUSTRIAL PHARMACY-II [Lab]

COURSE # PD-606 **Cr. Hr. 01**

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

1). Ampule filling, sealing and sterilization clarity and leakage tests in injectables.

2). Capsule filling by semi automatic machine.

3). Manufacture of sustained action drugs.

4). Tablets Tests like Disintegration. Dissolution, Friability, Hardness and Thickness tests. Determination of weight variation in tablets. Density of powder. Particle size analysis.

RECOMMENDED BOOK:

1).Lachman, theory and Practical of Industrial Pharmacy, Varghese Publishing House, Bombay, 1987.

2).Cooper and Gunn's, Tutorial Pharmacy, CBS Publishers & Distributors, New Dehli, 1986.

3).Bentley's Pharmaceutical Text Book, CBS Publishers & Distributors, New Dehli, 1986.

4).Remington's Pharmaceutical Sciences, Mack Publishing Company, USA, 2001.

5).John Sharp, Good Pharmaceutical Manufacturing Practice, Rational and Compliance.

PHARMACEUTICAL QUALITY MANAGEMENT-II [TH]
COURSE # PD-608 **Cr. Hr. 03**

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

2. ALCOHOL DETERMINATION: Alcohol metric methods, Problem during distillation of alcohol, Method of Liquids containing less than 30% and more than 30% alcohol and special treatment before distillation.

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

4. MISCELLANEOUS DETERMINATION AND TESTS: Determination of weight / ml, water / Moisture content, loss on drying, Toxicity tests & Identification tests, Evaluation of ointment, Ash contents and Alkalinity of glass.

5. GENERAL KNOWEDGE OF APPENDICES ATTACHED TO B.P., B.P.C., AND U.S.P .

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

7. STATISTICAL INTERPRETATION OF QUALITY CONTROL CHARTS DURING MANUFACTURING PROCESSES:

PHARMACEUTICAL QUALITY MANAGEMENT-II [Lab]
COURSE # PD-610 **Cr. Hr. 01**

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e. g. Sterility test, Determination of Ash contents, Determination of Moisture contents, Determination of total solids, Determination of viscosity of syrups and gels. Determination of emulsion types, glass alkalinity test, evaluation of packaging material etc.

RECOMMENDED BOOKS:

1). A. H. Beckett and J. B. Stennlake, Practical Pharmaceutical Chemistry, Part-I and II. The Alton Press, London.

2). A. M. Kneval and F. E Digangi, Jenkin's, Quantitative Pharmaceutical Chemistry, Mac Graw-Hill, Book Company, New York.

3). K. A. Connors, A text Book of Pharmaceutical Analysis John – Wiley and Sons, New York.

4). A. Braithwaite and F. J. Smith, Chromatographic Methods, Chapman and Hall, London.

5). G. D. Christian, Analytical Chemistry, John Wiley and Sons, New York.

6). Karami A. Javaid, Pharmaceutical Quality Assurances in Class, Industry and Market, Aziz Publishers, Lahore, Pakistan (1993).

7). Gil Bismuth and Shosh Neumann, Cleaning Validation, A Practical approach, CRC, Press LLC, USA, 2003.

8). J. T. Carstersen and C. T. Rhodes, Drug Stability: Principles and Practices, 3rd Edition (recived and exended) Mercel Decker, New York, 2000.

9). Sydney H. Willige, Good Manufacturing Practices for Pharmaceuticals. Marcel Dekker Publishing.

10). Braun RE, Introduction to Instrumental Analysis, Mec Graw-Hill Book Co, NY, 1987.

11). Bryant R, The Pharmaceutical Quality Control Hand Book, Aster Publishing Corporation, Eugene, 1989.

CLINICAL PHARMACY-II [TH]
COURSE # PD-612 **CR. HR.03**

1. **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.

2. DRUG INDUCED DISEASES:/ TARGET ORGANS OF TOXICITY

a. Toxic responses of blood
b. Toxic responses of Liver
c. Toxic responses of Heart
d. Toxic responses of Kidney
e. Toxic responses of Reproductive system
f. Drug induced Brain diseases.
g. Drug induced skin diseases.

5. MANAGEMENT OF DISEASES

i. EYE DISORDERS

Conjunctivitis
Cataract
Glaucoma

ii. INFECTIOUS DISEASES:

Malaria, Dengue, Tetanus, Measles, Rabies, AIDS, Herpes, hepatitis, diarrhea, TB, Urinary tract infections, fungal infections, Pneumonia, Bronchiolitis, typhoid, meningitis.

iii. MISCELLANEOUS DISEASES

Bone Mineralization, Arthritis and Gout

3. **PHARMACEUTICAL CARE, ITS SCOPE, MANAGEMENT AND APPLICATION OF CARE PLAN:**

PHARMACOTHERAPY PLAN:

I. Development, Implementation and Monitoring of 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:

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

4. ONLINE 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.

CLINICAL PHARMACY-II [Lab]
COURSE # PD-614 **Cr. Hr. 01**

Clerkship in the clinical setting / a project related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.

RECOMMENDED BOOK:

1). Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Livingston, London, 3rd Ed. 2003.

2). Guard Paul, A Behavioral Approach to Pharmacy Practice, Black well , USA, 2000.

3). Herfindel Gourley, Clinical Pharmacy & Therapeutics, William & Wilkins, London. 1992.

4). A. J. Winfield, Pharmaceutical Practice, Churchill Livingstone, London, 2nd Ed. 1998.

5). Kavin Taylor, Pharmacy practice , Taylor & Francis, New York, 1998./

6). Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 2nd Ed. Sarris on, Inc North Carolina USA.

7). Simon Cook, Clinical, Studies Management a Practical Guide to Success, Sue Horwood Publishing limited, West Sussex, UK.

8). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2003.

9). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2002.

10). Mellainie J. Rantucci, Pharmacist Tallding with Patient .1997.

11). Smith GDG and Aronson JK. Oxford Text Book of Chemical Pharmacology and Drug Therapy Oxford University ,Press, UK. 1990.

12). Hasten P and Horn J. Drug Interaction. Lee & Febiger, Philadelphia. USA, 1989.

MEDICINAL CHEMISTRY-II [TH]

PD- 618 **Cr. Hr. 03**

To study the chemistry, structure , mechanism of action, structure activity relationship and therapeutic applications of the following:

1. **Local Anaesthetics**
   Benzoic acid derivatives, Lidocaine derivatives (anilides), amiono benzoic acid, miscellaneous compounds such as : Procaine, lignocaine, eucaine, cocaine and benzociane.

2. **Central Nervous system Depressants**
   General anesthetics, inhalation anesthetics, ultrashort acting barbiturates, dissociative anesthetics such as cyclopropane, halothane, nitrous oxide, chloroform , thiopental sodium, ketmaine, methohexital, thiomylal sodium, fantanyl citrate, tribromo ethanol.

   Anxiolytics, sedative , hypnotics, such as benzodiazepines, barbiturates, paraldehyde, glutethimide, chloral hydrate and alcohols.

   Anti-convulsants such as barbiturates, hydantoins, oxazolidinediones, succinimides, benzodiazepines.

   Antipsychotics, such as phenothiazines, fluorobutyrophenones, β- aminoketones, CNS depressants with skeletal muscle relaxant properties.

3. **Central Nervous system stimulants.**
   Analeptics, Picrotoxin, methylxantines, monoamine oxidase inhibitors, tricycle compounds , indolethylamines, 2-phenylehylamines.

4. **Diuretics**
   Carbonic anhydrase inhibitors , thiazide and thiazide like diuretics, high ceiling or loop diuretics, potassium sparing diuretics and miscellaneous compounds such as mercaptomerin , meralluride, Thiazides, sprironolactone, theophylline, frusemide, acetazolamide, ethacrynic acid, triametrene.

5. **Anti- Neoplastic Agent**
   Alkylating agents, antimetabolites, antibiotics, plant products, miscellaneous compounds, hormones, immunotherapy, such as methotrexate, 5-fluorourecil, antinomyciens, anthracyclines, vincristine, tamoxifen.

6. **Cardiovascular Agents**
   Antianginal agents and vasodilators, antiarrhythimc drugs, antihypertensive agent, angiotensin-converting enzyme inhibitors, antihyperlipidemic agents , anticoagulants.

7. **Anti histamines**
   H1- antagonists, H2- antagonists , aminoalkyl ethers, ethlenediamines, propylamine derivatives, phenothiazine derivatives, piperazine derivatives, suchas diphenhydramine,

pyrilamine, promethazine, cyclizine, terfenadine, sucralfate, cimetidine , ranitidine, omeprazole.

8. **Anti Tubercular Agents.**
   Ethambutol, isonicotinic acid, hydrazid, rifampicin, thioguanine, cytarabine, 5-flurouracil, dicarbazine, cycloserine, streptomycin.

MEDICINAL CHEMISTRY- I [LAB]

PD- 620 **Cr. Hr. 01**

1. Estimation of functional groups; carboxylic , hydroxyl, Amino and Nitro groups, Determination of Molecular weights of Organic Compounds.

2. Synthesis of following Drugs.
    a. Paracetamol
    b. Salicylic Acid
    c. Methyl Slicylate
    d. Azobenzene
    e. Benzoic Acid
    f. 5-Hydroxy-1,3-benzoxazol, 2-one
    g. Aspirin
    h. P-nitrosophenol
    i. 3-nitrophthalic acid
    j. O-chlorobenzoic acid

FIFTH PROFESSIONAL

SEMESTER IX:

CLINICAL PHARMACY-III [TH]
PD- 701

INTRODUCTION TO ESSENTIAL DRUGS:

Criteria for selection, Usage and advantages.

2) ROLE OF CLINICAL PHARMACY IN COMMUNITY PHARMACY:

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

4) CLINICAL TRIALS OF DRUG SUBSTANCES:

A) Designing of clinical trials,

B) Types of trial,

c) Choice of Patients.

d) Inclusion and Exclusion of patient

e) Monitoring a clinical trials.

5. DRUG UTILIZATION EVALUATION & DRUG UTILIZATION REVIEW (DUE / DUR):

5. DISEASE MANAGEMENT:

Disease management should be covered by considering aspects like diseases definition, etiology, pathogenesis, clinical presentation, diagnostic work out (briefly), pharmacotherapy.

i. **Respiratory Disorders:**
Asthma, Emphysema, COPD, Covid, Common cold, Tonsilitus, Phyrinjitis, Bronchitis.

ii. **Gastrointestinal Disorders:**
Inflammatory Bowel Diseases, Liver cirrhosis, Portal hypertension, Peritonitis, Pancreatitis Cholecystitis

iii. **Cardiovascular Disorders**
Hypertension, Angina, MI, CHF, Arrhythmias, Shock, Atherosclerosis

iv. **Hematology**:

Bleeding disorders/coagulopathies/clotting disorders e.g. thrombocytopenia, hemophilia, Vit. K deficiency, Anemia

References:

1). Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Livingston, London, 3rd Ed. 2003.

2). Guard Paul, A Behavioral Approach to Pharmacy Practice, Black well , USA, 2000.

3). Herfindel Gourley, Clinical Pharmacy & Therapeutics, William & Wilkins, London. 1992.

4). A. J. Winfield, Pharmaceutical Practice, Churchill Livingstone, London, 2nd Ed. 1998.

5). Kavin Taylor, Pharmacy practice , Taylor & Francis, New York, 1998./

6). Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 2nd Ed. Sarris on, Inc North Carolina USA.

7). Simon Cook, Clinical, Studies Management a Practical Guide to Success, Sue Horwood Publishing limited, West Sussex, UK.

8). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2003.

9). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2002.

10). Mellainie J. Rantucci, Pharmacist Tallding with Patient .1997.

11). Smith GDG and Aronson JK. Oxford Text Book of Chemical Pharmacology and Drug Therapy Oxford University ,Press, UK. 1990.

12). Hasten P and Horn J. Drug Interaction. Lee & Febiger, Philadelphia. USA, 1989.

CLINICAL PHARMACY-III [Lab]

COURSE # PD-703 **Cr. Hr. 01**

Clerkship in the clinical setting and a project related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.

RECOMMENDED BOOK:

1). Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Livingston, London, 3rd Ed. 2003.

2). Guard Paul, A Behavioral Approach to Pharmacy Practice, Black well , USA, 2000.

3). Herfindel Gourley, Clinical Pharmacy & Therapeutics, William & Wilkins, London. 1992.

4). A. J. Winfield, Pharmaceutical Practice, Churchill Livingstone, London, 2nd Ed. 1998.

5). Kavin Taylor, Pharmacy practice , Taylor & Francis, New York, 1998./

6). Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 2nd Ed. Sarris on, Inc North Carolina USA.

7). Simon Cook, Clinical, Studies Management a Practical Guide to Success, Sue Horwood Publishing limited, West Sussex, UK.

8). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2003.

9). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2002.

10). Mellainie J. Rantucci, Pharmacist Tallding with Patient .1997.

11). Smith GDG and Aronson JK. Oxford Text Book of Chemical Pharmacology and Drug Therapy Oxford University ,Press, UK. 1990.

12). Hasten P and Horn J. Drug Interaction. Lee & Febiger, Philadelphia. USA, 1989.

PHARMACEUTICAL TECHNOLOGY-I [TH]
COURSE # PD-705 **Cr. Hr. 03**

1). PRINCIPAL OF PHARMACEUTICAL FORMULATION AND DOSAGE FORM DESIGN:

Product Formulation, Need for Dosage form and Preformulation studies.

1. **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). NOVEL GIT DRUG DELIVERY SYSTEM (DDS):

- Oral Osmotic Pumps
- Ion-Exchange Controlled DDS
- pH-Controlled DDS
- Bio/mucoadhesive DDS
- Floating DDS

4). DRUG CARRIER SYSTEM:

- Liposomes
- Niosomes

5). TARGETED DRUG DELIVERY SYSTEM:

- Active Drug Delivery System
- Passive Drug Delivery System

RECOMMENDED BOOKS:

1). Anya M. Hellery, Drug delivery and targeting. Taylor & Frances, London, 2001.

2). Joseph R. Robinson controlled drug delivery Marcel & Dakker Inc, New York, 2nd Ed. 1987.

3) T. V. Ramabhadran, Pharmaceutical design and development, Ellis Horwood, New York.1994.

4). M. E. Aulton, Pharmaceutics: Science of dosage forms design, ELBS / Churchill Livingston, London 1998.

5). Banker, Modern Pharmaceutics, Marchell Dakker Inc, New York, 1990.

6). John A. Bontempo, Development of Bio-Pharmaceutical Parenteral dosage forms, Marchill Dakker Inc, New York, 1997.

7). N. K. Jain Controlled and Novel drug delivery, publisher & Distributors, New Dehli, 1997.

8). Ansel, Pharmaceutical Dosage form and Drug Delivery System, Lee & Febiger, London, 1990.

9). AttaurRehman and M. I. Chaudry, Bioassay, techniques for drug development, CRC Press LLs, USA, 2001

10). Pramod K. Gupta, Inject able drug development CRC, press LLC. USA, 1999.

11). H. John Smith, Introduction to the Principal of drug design and action CRC, Press LLC, USA, 1998.

12).Rong Liu, Water Insoluble drug Formulation, CRC Press LLC, USA, 2000.

13).Peter Blaisdell. Twenty first Century Pharmaceutical Development. CRC Press LLC, USA, 2000.

14).Lachman L, Theory and Practice of Industrial Pharmacy, Lee & Febiger, Philadelphia, 3rd Ed, 1986.

FORENSIC PHARMACY-I [TH]
COURSE # PD-707 Cr. Hr. 02

1. Introduction:

a) Basic concept of Law and Justice , Type of Laws, How the Law are derived.

b) **LEGAL SYSTEM:** Impact of Legal System, component of legal system, types of legal system, Law and Islam, Islamic legal system, Acts, Rules , Section , Sub Section.

2) Drug Act 1976
3) The Drug Advertising Rules 1976
4) Drug regulatory Authority of Pakistan (DRAP) Act 2012
5) Pharmacy Act 1976
6) Provincial Drug Rules (Sind Drug rules 1979)
7) Factories Act 1934
8) Shop & Establishment Ordinance 1969

RECOMMENDED BOOKS:

1) R. Z. Hussain. The manual of drug Laws in Pakistan, Irfan Law Book House, Lahore, Pakistan, 2003.

2) DRAP 2012

3) The Pharmacy Act 1967.

4) The Factory law 1934.

5) Shop and Establishment Ordinance 1969.

BIOPHARMACEUTICS & PHARMACOKINETICS-I [TH]
COURSE # PD-709 **Cr. Hr. 03**

1). **DEFINITIONS AND TERMINOLOGY:** Bio Pharmaceutics, Generic Equivalence, Bio availability, Bio Equivalence, Drug Disposition, Therapeutics, Pharmacokinetics, Biotransformation and Therapeutic Equivalence.

2). **GASTRO-INTESTINAL ABSORPTION AND PHYSICO-CHEMICAL CONSIDERATION:** Forces which help in transmembrane movements, pH partition Theory, Lipid Solubility and Factors affecting Bioavailability.

3). **BIOAVAILABILITY STUDIES:** Purpose, Relative and absolute Bioavailability, and Determination of Bioavailability.

4). **FACTORS AFFECTING DISSOLUTION IN RESPECT OF BIOAVAILABILITY:** Methods of in-vitro and in-vitro determination of rate of dissolution.

5). **BIOPHARMACEUTICAL AND PHARMACOKINETIC ASPECTS IN DEVELOPING A DOSAGE FROM**

6). **ELIMINATION OF DRUGS:**

a). **Hepatic Elimination:** Percent of drug Metabolized, drug biotransformation reactions, (Phase-I and Phase-II reactions).First pass effect, Hepatic clearance of protein bound drugs and excretion of drugs.

b). **Renal Excretion of Drugs:** Renal clearance, Glomerular filtration, Tubular Secretion, Tubular Reabsorption.

c). **Elimination of drugs through other organs:** Pulmonary excretion, Salivary excretion, mammary excretion, Skin excretion and genital excretion.

7). **PROTEIN BINDING:** Drug-protein binding.

RECOMMENDED BOOKS:

1). Leon Shargel, Applied Pharmacokinetics and Bio Pharmaceutics, Appleton & Lange New York 4th Ed, 1999.

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

3). Milo Gibaldi, Bio-Pharmaceutics and Clinical Pharmacokinetics, Marchel & Dakker Inc, New York, 1982.

4). Gibbson and Skett. Introduction to Drug Metabolism, Champ & Hall, London, 1986.

5). Robert E. Notari, Bio-Pharmaceutics and clinical Pharmacokinetics, Marchel & Dakker Inc New York, 1988.

6). Stephen H. Curry. Drug disposition and Pharmacokinetics. Black Well Scientific publishing, Oxford, 1977.

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

8). Serfraz Niazi, text book of Bio-Pharmaceutics and Clinical Pharmacokinetics, Appleton-Century Crofts, NewYork, 1985.

9). P. Macheras, C. Reppas and J. B. Dressman. Bio-Pharmaceutics of orally administered drugs, Wllis Horwood Limited, London 1995.

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

11). Ronald D. Schoenwald, Pharmacokinetics in drug discovery and Development, CRC, Press, SLLC, USA, 2002.

PHARMACEUTICAL MARKETING & MANAGEMENT-I [TH]
COURSE # PD-711 **Cr. Hr. 03**

1. Management:

Nature & Principle of Management

Function of Manager & Type of Manager.

Management core as management movement

2. Planning

Purpose & types of planning steps in planning.

Strategic planning in pharmacy operation.

Business planning for pharmacy program

3. Organizing

Defining organizational structure and behaviour

Organizational design decision

Human Resource management function

Customer service (Managing service delivery)

Organizational communication

How I.T affects organization

Managing changing innovation

4. **Leading**

Understanding groups & team

Motivating Employee

Leadership

5. Controlling

Steps in control process

Managing value added services

Managing risk in Pharmacy practice.

6. Production Management

Introduction Material : Distribution system, Supply chain management, operation management.

7. Purchase & Inventory Management Merchandising

8. Financial Management

Budgeting

Accounting

Recording & Reporting Financial Data

Analysis of Account

Planning & Control

9. Pharmaco Economics

Introduction

Basic Economic Principals

Method of Economic Evaluation

Modeling and Sensitivity Analysis

Appraising Economic Evaluation

RECOMMENDED BOOK:

1). M. Ahmed & N. I. Bukhari, Pharmaceutical Management and Marketing, Tariq Academy , Faisalabad, Pakistan, 2002.

2). C. Patrick Tharp & Pedro J. Lecca, Pharmacy management for students and Practitioners, the C. V. Mosby Company, St.Louis, Toronto, London. 1979.

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

MEDICINAL CHEMISTRY- III [TH]

PD- 713 **Cr. Hr. 03**

Medicinal Chemistry III

1. DNA recombinant technology / Genetic engineering (with reference to drug designing).

2. To study the chemistry, structure , mechanism of action, structure activity relationship and therapeutic applications of the following.
Sulphonamides such as sulfamethoxazole, sulfadiazine, sulfafurazole.

3. Hypoglycemic agents such as sulfunylureas tolbutamide, chlorpropamide, acetohexamide, glipizide , glyburide,

4. Antibiotics such as penicillines, cephalosporins, strepto-mycin, chloramphenicol, tetracyclines, kanamycin and erythromycin.

5. Antimalarial agents such as 4-aminoquinolines, 8- aminoquinolines, 9-amino acridiens, biguanides, pyrimidine, analogues , mefloquine, cinchona alkaloids.

6. Anti-helminthic such as piperazine derivatives, thiabendazole, medendazole, pyrantal.

7. Anti-viral agents such as acyclovir, tromantadine hydrochloride , ribavirin.

8. Alkaloids: Atropine, morphine and related compounds (codeine, thebaine), ergotamine, reserpine, ephedrine.

9. Adrenergic agents neurotransmitters , receptors , agonists and antagonists.

10. Cholinergic agents neurotransmitters , receptors , agonists and antagonists.

MEDICINAL CHEMISTRY - II [LAB]

PD- 715 **Cr. Hr. 01**

1. Assay of the following Drug:
    a. Sulpha drugs
    b. Aspirin
    c. Paracetamol
    d. Benzyl Penicillins
    e. Inorganic Preparations.

SEMESTER X:

CLINICAL PHARMACY-IV [TH]
COURSE # PD-702 Cr. Hr. 03

1). RATIONAL USE OF DRUG:

Rational Prescribing, Rational Dispensing, Problems of Irrational drug use, learning about drug use problem sampling to study drug use indicators of drug use.

2. THERAPEUTIC DRUG MONITORING:

Digoxin, Theophyline, Gentamycin,Lithium, Phenytoin ,Cabamazepine, Phenobarbitone, Primidone, Valproic acid, Cyclosporins and Vancomycin.

3) SAFE INTRAVENOUS THERAPY & HAZARDS OF INTRAVENOUS THERAPY

4). PATIENT COMPLIANCE:

Definition, introduction and importance extent of non-compliance, methods of assessment, Reasons for non-compliance, strategies for improving compliance and Designing of compliance trials.

5). DISEASE MANAGEMENT:

Disease management should be covered by considering aspects like diseases definition, etiology, pathogenesis, clinical presentation, diagnostic work out (briefly), pharmacotherapy.

i. ENDOCRINE DISORDERS

Diabetes Mellitus, Growth Disorders, Thyroid Disorders, Urino-Genital Disorders, Adrenocortcal Disorders, Pituitary gland non-malignant disorders.

ii. RENAL DISORDERS

Nephritis, ESRD, Nephrotic syndrome

iii. CNS DISORDERS:

Epilepsy, Psychosis, Stroke, Schizophrenia, Parkinsons Disease
Anxiety, Depression, Alzhimer's Disease

iv. ONCOLOGY

Leukemia, Thalasemia, Breast Cancer, Colorectal Cancer, Lung Cancer
Prostate cancer

v. DERMAL DISORDERS

Dermatitis, Urtecaria, Acne,Leucoderma, Leprosy,

vi. **EMERGENCY TREATMENT:**

For example, Cardiopulmonary resuscitation (CPR), Cold Blue.

CLINICAL PHARMACY-IV [Lab]

COURSE # PD-704 **Cr. Hr. 02**

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.

RECOMMENDED BOOK:

1). Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Livingston, London, 3rd Ed. 2003.

2). Guard Paul, A Behavioral Approach to Pharmacy Practice, Black well , USA, 2000.

3). Herfindel Gourley, Clinical Pharmacy & Therapeutics, William & Wilkins, London. 1992.

4). A. J. Winfield, Pharmaceutical Practice, Churchill Livingstone, London, 2nd Ed. 1998.

5). Kavin Taylor, Pharmacy practice , Taylor & Francis, New York, 1998./

6). Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 2nd Ed. Sarris on, Inc North Carolina USA.

7). Simon Cook, Clinical, Studies Management a Practical Guide to Success, Sue Horwood Publishing limited, West Sussex, UK.

8). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2003.

9). Joseph T. Dipiro, Encyclopedia of Clinical Pharmacy. Mareel Dekker Publishing, 2002.

10). Mellainie J. Rantucci, Pharmacist Tallding with Patient .1997.

11). Smith GDG and Aronson JK. Oxford Text Book of Chemical Pharmacology and Drug Therapy Oxford University ,Press, UK. 1990.

12). Hasten P and Horn J. Drug Interaction. Lee & Febiger, Philadelphia. USA, 1989.

PHARMACEUTICAL TECHNOLOGY-II [TH]
COURSE # PD-706 Cr. Hr. 03

1). NOVEL DRUG DELIVERY SYSTEM:

i) The concept of sustained release, First order release approximation, Multiple dosing, Implementation of designing, approaches based upon dosage form modification, product evaluation and testing, Matrices tablets, Control release technology.

ii) Developmental aspects of Matrix and Reservoir Systems

iii) Sustained/ Controlled Release Drug Delivery System

i. Microencapsulation technique
- Coacervation
- Solvent evaporation
- Interfacial polymerization
- Spray drying

2). POLYMERS USED IN DRUG DELIVERY SYSTEMS

3). PHARMACEUTICAL BIOTECHNOLOGY:

Introduction to Biotechnology: Genomics, Proteonomics , Pharmacogenomics and Gene therapy. Biotechnological aspects in the product development, Fundamentals of Genetic Engineering and its application in Medicine. Principle, Synthesis and application of Monoclonal Antibodies, Immobilized Enzymes and their application in Medicine. Pharmaceutical Recombinant therapeutic proteins and growth factors.

PHARMACEUTICAL TECHNOLOGY [Lab]
COURSE # PD-708 Cr. Hr. 02

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 requirements, e. g. Various techniques to develop the formulation Granulation, technology, Study of drug delivery system, Biotechnological aspect of product development, In-vitro Quality Control of various dosages forms, Microbial assay. Particle size analysis using various methods, Stability studies of Pharmaceutical, Coating of particles and to prepare, examine and control specification of packaging materials.

RECOMMENDED BOOKS:

1). Anya M. Hellery, Drug delivery and targeting. Taylor & Frances, London, 2001.
2). Joseph R. Robinson controlled drug delivery Marcel & Dakker Inc, New York, 2nd Ed. 1987.
3) T. V. Ramabhadran, Pharmaceutical design and development, Ellis Horwood, New York.1994.

4). M. E. Aulton, Pharmaceutics: Science of dosage forms design, ELBS / Churchill Livingston, London 1998.
5). Banker, Modern Pharmaceutics, Marchell Dakker Inc, New York, 1990.
6). John A. Bontempo, Development of Bio-Pharmaceutical Parenteral dosage forms, Marchill Dakker Inc, New York, 1997.
7). N. K. Jain Controlled and Novel drug delivery, publisher & Distributors, New Dehli, 1997.
8). Ansel, Pharmaceutical Dosage form and Drug Delivery System, Lee & Febiger, London, 1990.
9). AttaurRehman and M. I. Chaudry, Bioassay, techniques for drug development, CRC Press LLs, USA, 2001
10).Pramod K. Gupta, Inject able drug development CRC, press LLC. USA, 1999.
11). H. John Smith, Introduction to the Principal of drug design and action CRC, Press LLC, USA, 1998.
12).Rong Liu, Water Insoluble drug Formulation, CRC Press LLC, USA, 2000.
13).Peter Blaisdell. Twenty first Century Pharmaceutical Development. CRC Press LLC, USA, 2000.
14).Lachman L, Theory and Practice of Industrial Pharmacy, Lee & Febiger, Philadelphia, 3rd Ed, 1986.

FORENSIC PHARMACY-II [TH]
COURSE # PD-710 Cr. Hr. 02

1. **Control of Narcotic Substances Act 1997**
2. **Poisons Act 1919**

3. Forensic Pharmacy

Forensic Pharmacy and 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 record keeping. Drug control administration at federal and provincial level

4. Role of forensic pharmacist

Forensic drug measurement, postmortem redistribution (PMR), medication errors, prescription forgery, product tampering, insurance fraud, use of drug or alcohol in car accidents or violent actions, legal and illegal pharmaceutical evidence in criminal investigation, use of abused drugs in the work place, professional mal practice, quackery and health care fraud.

5. Pharmaceutical Ethics

Patents and generics, ethics in sales, ethics in industry, ethics in research.

6.International Accreditation system for hospitals: Joint commission (The Joint Commission was formerly the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and previous to that the Joint Commission on Accreditation of Hospitals (JCAH) for accreditation of Hospitals and rules under this commission.

RECOMMENDED BOOK:

1. R. Z. Hussain. The manual of drug Laws in Pakistan, Irfan Law Book House, Lahore, Pakistan, 2003.

BIOPHARMACEUTICS & PHARMACOKINETICS-II [TH]
COURSE # PD-712 **Cr. Hr. 03**

1). INTRODUCTION TO PHARMACOKINETICS:

Determination through plasma drug level studies. Application of Pharmacokinetics in clinical situations.

2). CONCEPT OF COMPARTMENT (S) MODELS:

One compartment open model. Two compartments open model. Three compartments open model and non-compartmental method of analysis.

3). BIOLOGICAL HALF-LIFE AND VOLUME OF DISTRIBUTION:

Concept and Methods of determination.

4). DRUG CLEARANCE:

Mechanism, determination and relationship of clearance with half-life.

5). MULTIPLE DOSAGE REGEMIN:

6). INTRAVENOUS INFUSION:

7). APPLICATIONS OF PHARMACOKINETICS AND BIOAVAILABILITY IN CLINICAL SITUATION:

8). APPLICATIONS OF PHARMACOKINETICS IN DISEASE STATES:

BIOPHARMACEUTICS & PHARMACOKINETICS [Lab]
COURSE # PD-714 **Cr. Hr. 02**

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

1) Plasma level-time curve of different compartmental Models.
2) Determination of Pharmacokinetic parameters.
3) Determination of plasma protein binding.
4) Urinary sampling techniques, in laboratory animals and humans.
5) Disintegration test of immediate release tablets, enteric coated tablets and capsules.
6) Dissolution test of immediate release oral solid dosage, enteric coated tablets.
7) To perform f_2 & f_1 similarity test (biowaiver)
8) To perform blood sampling on human volunteers
9) Collection of blood sample from rodents (mice and rats)
10) Collection of blood sample from rabbits
11) Preparation of sample for HPLC analysis
12) Demonstration of method of analysis by HPLC

RECOMMENDED BOOKS:

1).Leon Shargel, Applied Pharmacokinetics and Bio Pharmaceutics, Appleton & Lange New York 4th Ed, 1999.
2).Malcoln Rouland, Thomous N. Tozer, Pharmacokinetics, William & Willkins, London, 1995.
3).Milo Gibaldi, Bio-Pharmaceutics and Clinical Pharmacokinetics, Marchel & Dakker Inc, New York,1982.
4).Gibbson and Skett. Introduction to Drug Metabolism, Champ & Hall, London, 1986.
5).Robert E. Notari, Bio-Pharmaceutics and clinical Pharmacokinetics, Marchel & Dakker Inc New York, 1988.
6).Stephen H. Curry. Drug disposition and Pharmacokinetics. Black Well Scientific publishing, Oxford, 1977.
7).Avraham Yacobi., Toxicokinetics, and New Drug Development. Paramount Press, New York, 1989.
8).Serfraz Niazi, text book of Bio-Pharmaceutics and Clinical Pharmacokinetics, Appleton-Century Crofts, NewYork, 1985.
9).P. Macheras, C. Reppas and J. B. Dressman. Bio-Pharmaceutics of orally administered drugs, Wllis Horwood Limited, London 1995.
10).Albert P. Li, In-vitro approaches for evaluation of drug efficacy and toxicity, CRC. Press, LLC, USA, 2004.
11).Ronald D. Schoenwald, Pharmacokinetics in drug discovery and Development, CRC, Press, SLLC, USA, 2002.

PHARMACEUTICAL MARKETING & MANAGEMENT-II [TH]

COURSE # PD-716 **Cr. Hr. 03**

1. **Marketing:**
   Definition , Process, Marketing concept, Understanding Marketing Place & consumer need, Marketing Environment, Consumer & Bayer Behavior.

2. **Segmentation :**
   Targeting & Positioning, Segmenting Business Market, Requirement of Effective Segmentation, Evaluating Market segment, Selecting target segment , Position map, choosing a positioning Strategy.

3. **Product service , bonding Strategies.**
   Introduction, Product & Service decision
   Branding Strategies
   Service Marketing.

4. **Pricing Consideration & Strategies:**
   Introduction, Factors, New product pricing strategies, Product mix pricing strategies, Price adjustment strategies, Pricing Pharmaceutical Product, Public Policy and Pricing.

5. **Marketing Channels & Supply chain Management:**
   Nature and importance of marketing Channel Design decision, Channel Management decision, Public Policy.

6. **Retailing & Whole selling:**
   Types of Retailer & Whole seller retailer Marketing Decision.

7. **Integrated Marketing Communication :**
   Advertising, Sales, Promotion & Public Relation

   Personal Selling & direct marketing

8. **Sales Managements :**
   Function of Sales, Qualities of Sales Manger , Types of Sales Manger Sales force management , control of Sale force, Sale forecast, Remuneration, Customer Relationship.

RECOMMENDED BOOKS

- Principles of Marketing by Kurz / Bone
- Marketing Management by Czinkota, Kotabe
- Introduction to Marketing by Arm strong / Cotter
- Marketing by Roger A Kerin, Steven W Hart Lay Exc N Berkoitz, William Rudilius
- Modern Marketing Principle and Practices R.S.N Pillai bgavathi.