



UNIVERSITY OF SINDH
JAMSHORO, PAKISTAN



FACULTY OF PHARMACY

SCHEME OF COURSES FOR PHARM. D. (FIVE YEAR COURSE)

BATCH 2015 TO ONWARDS

(Third Edition 2019)

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UNIVERSITY OF SINDH

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Merritorious Professor & Dean

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THE PHARMACY

Pharmacy is the art and Science of preparing and dispensing drugs for the prevention and cure of disease. Records from ancient Egypt, Assyria, China and India shows that the pharmacy has been intimately connected with medicine and with the natural sciences.

In earliest times, pharmacy was closely interwoven with medicine to the extent that one person usually carried out both functions. As both professions matured, the need for separate specialties became clear, although it remained equally clear they would need to retain close relations for the greatest benefit to the patient. The physician may prescribe drugs, nurse may administer drugs, but the pharmacist is the member of the health care team whose expertise is in the appropriate use of drugs.

The primary role of pharmacist is to assure that the medications used by the patient are the most effective and are used in the most appropriate manner. This is done in cooperation with the patient and through consultation with other health care professionals.

Pharmacists assume a wide variety of specialization within the health care field. The majority of pharmacists work in community pharmacies (retail pharmacy) where they have responsibility for the medication and health care needs of the general community. Pharmacists also work in hospitals, in research and teaching, and in the pharmaceutical industry. Whereas hospital pharmacist are primarily responsible for assuring the appropriate use of medicine by institutionalized patients, research pharmacists are generally involved in the development of new medicines and dosage forms, in the determination of how medicines alleviate disease, and in the assessment of the social and economic factors influencing the use of medicines. As teachers they may be involved in the education of pharmacy students.

Industrial pharmacists might work in sales, drug information, regulatory affairs, production, quality control or research within the pharmaceutical industry. Government department with public health concerns also employ pharmacists in analytical or toxicology laboratories, as inspectors, or in the armed forces.

PHARMACY EDUCATION OBJECTIVES

A. General objectives

1. The objectives of pharmacy education (Doctor of Pharmacy Degree Course) are to prepare a health caring and community oriented pharmacist who is competent to deal with the health and pharmaceutical based problems of the people in a scientifically sound and cost-effective manner using appropriate technology and holistic approach.
2. A student after completion of his study in Doctor of Pharmacy Degree Course is able to practice pharmacy, subjected to registration with Provincial Pharmacy Council.

B. Knowledge Related Objectives

1. A pharmacy graduate at the conclusion of his study in Doctor of Pharmacy Degree Course possess specific knowledge, attitudes, skills and behavior and is able to apply the knowledge of:

- (a) The principles of science that are essential for understanding the human structures, functions and behavior in health and disease including-
 - (i) Structure and function of cells, organs and systems, and their adaptation to drugs and disease; and
 - (ii) Behavior of man as an individual, as a family member, and as a community member;
- (b) Macroscopic and microscopic structures of human body from conception to completion of growth;
- (c) Functions of normal human body at all levels of development;
- (d) Abnormalities of structures and functions of human body and their causative agents;
- (e) Clinical presentations of health and disease in terms of processes, both physical and mental;
- (f) Preventive and therapeutic measures for management of health and disease;
- (g) Legal aspects of pharmacy practice;
- (h) Normal human behavior and disorders of human behavior resulting from non-organic causes;
- (i) Present and future health problems of community and solutions of such problems through planning, implementation, critical evaluation and research in preventive programs;
- (j) Handling of all common and health emergencies;
- (k) Role of socio-cultural background, socio-economic factors, and changing environment in health and illness;
- (l) Principles of drug surveillance;
- (m) Concept of reproductive health and understanding of all related drug matters; and
- (n) Basic principles of pharmacy ethics.

2. A pharmacy graduate at the conclusion of his study has sound knowledge of the following, namely:-

- (a) Comprehensive concept and knowledge of drugs and their development;
- (b) Therapeutic uses of all drugs and medicines;
- (c) Toxicological manifestation of drugs and their side effects;
- (d) Management of drug induced toxicology;
- (e) Management of drug administration;
- (f) Management of pharmaceutical care;
- (g) Complete understanding of drug posology; and
- (h) Unbiased source of drug administration.

C. Skills Related Objectives

1. A pharmacy graduate at the conclusion of his study in Doctor of Pharmacy Degree Course is able to:

- (a) Conduct interviews, take drug history of patients correctly, acquire ability to communicate and make accurate observations;
- (b) understand laboratory investigations and diagnostic reports, and interpret tests;
- (c) Perform administrative duty as member of health care team as well;
- (d) Promote rational drug use and dispense drugs rationally;
- (e) Know the requirements of dispensing;
- (f) Refer patients appropriately when required;
- (g) Monitor the prescription with reference to drugs interactions;

- (h) Monitor the adverse drug reaction and medication errors;
- (i) Dispense drugs aseptically;
- (j) Maximize the effect of drugs on patients;
- (k) Supervise the procurement, storage and drugs delivery system;
- (l) Provide information pertaining to poison and drugs to other health Professionals and public;
- (m) Act as Secretary, Pharmacy and Therapeutic Committee;
- (n) Perform his role as member of the Pharmacy and Therapeutic Committee; and
- (o) Evaluate and select drugs for the formulary.

2. In addition to the abilities specified at #. 1, a pharmacy graduate:

- (a) is able to acquire understanding of pharmaceutical manufacturing techniques;
- (b) is able to act as production pharmacist in normal activities related to manufacturing;
- (c) have adequate training in the fields of Quality Control (QC) and Quality Assurance (QA);
- (d) have adequate training in warehouse and packing of drugs;
- (e) is able to acquire understanding of pilot scale manufacturing;
- (f) is well aware of the concept of Good Manufacturing Practices (GMP) and Current Good Manufacturing Practices (CGMP);
- (g) is able to acquire understanding of pharmaceutical research and development;
- (h) is able to acquire understanding of economics of purchase for hospitals and community pharmacy;
- (i) is able to acquire understanding of proper storage conditions; and
- (j) is well aware of basic principles of pharmaco-economics, pharmaco-vigilance, pharmaco-dynamics and pharmaco-epidemiology.

D. Character and Attitude Objectives

A pharmacy graduate at the conclusion of his study in Doctor of Pharmacy Degree Course is able to-

- (a) display virtues and personal character such as sense of responsibility towards patients, community and colleagues;
- (b) respect patients right of confidentiality;
- (c) obtain informed consent;
- (d) recognize his Professional limitations;
- (e) develop and maintain good relations with patients and all persons concerned in the delivery of health care;
- (f) educate, guide and help in adoption of preventive and curative measures against disease;
- (g) improve his Professional knowledge, skills and attitudes continuously with a critical and enquiring approach;
- (h) show willingness to take part in education and training of students, para- medics and colleagues in health education;
- (i) assume leadership in the health care delivery team as well as accepts the leadership of his seniors, demonstrating a spirit of teamwork; and
- (j) identify himself with the community.

FACULTY OF PHARMACY

The Department of Pharmacy was established in 1974 at the Institute of Chemistry, Allama I. I. Qazi Campus University of Sindh, Jamshoro. The department was shifted in the present building in 1984 on super highway. The Department was upgraded to the Institute of Pharmacy in August 1999 and finally became Faculty on 2nd May 2005.

The Faculty of Pharmacy consists of following four departments:

1. **Department of Pharmaceutics.**
2. **Department of Pharmaceutical Chemistry**
3. **Department of Pharmacology**
4. **Department of Pharmacognosy**
5. **Department of Pharmacy Practice**

Since 1974 to 1989 the department offered B. Pharmacy degree and from 1989 the department started M. Pharmacy degree also. Since 1994 students are being registered for M. Phil./Ph. D. degrees. On the recommendation of Pharmacy Council of Pakistan the first batch of student is admitted in Pharm. D. Program (05 year course) in place of B. Pharmacy (04 year course) with effect from January 2004. Up to 1995, about 40-50 students were admitted every year but in recent years the number of admission has been reached to about 100 (including about 20% foreign nationals from about 12 countries) out of large number of applicants.

EVENING PROGRAM:

As a job oriented discipline and the only institute catering Pharmacy education to the people of Sindh, except Karachi, every year a huge number of applications for admission is received. This is very much natural and is expected to be increased by many folds in future. Therefore, in addition to morning classes this institute is also admitting equal number of students in evening under economical self finance scheme.

RESEARCH:

To explore the scope and achievements in research in medicine and to identify the ways and means for their optimal utilization in health promotion with focus on cure and prevention of disease this Faculty beside teaching is also involved in the research. At present the following few research projects are in progress.

1. Evaluation of short course regimens of chemotherapy in the treatment of pulmonary tuberculosis.
2. Biosynthesis of amino acids by fungi using agricultural waste as substrate.
3. Ecological aspects of Trichoderma.
4. Chemical and Biological Investigations/Screening of local medicinal plants.
5. Antimicrobial activity of local plants of medicinal nature.
6. Comparative Chromatographic determination of Polyamines in Normal Human & cancer patients.
7. Drug Delivery and development.

FACULTY OF PHARMACY, UNIVERSITY OF SINDH, JAMSHORO

VICE CHANCELLOR

Professor Dr Fateh Muhammad Burfat

DEAN

Merritorious Prof. Dr. Abdullah Dayo

LIST OF FACULTY MEMBERS

DEPARTMENT OF PHARMACEUTICS

DR. DAYO ABDULLAH, Meritorious Professor & Dean

B.Pharm. (S.U) 1986, M.Pharm. (Punjab) 1988 & Ph.D. 1996 (China)

MUGHAL UBED-UR-REHMAN, Professor & Chairman

B.Pharm. 1998 (S.U) M.Phil (S.U) 2009, Ph.D. 2016 (S.U)

SUHERYANI IMRAN, Associate Professor

B. Pharm 2005, M.Phil 2013 (H.U), Ph.D. 2017 (China)

RAJPUT SALMAN AHMED, Assistant Professor

Pharm D 2009 (S.U), M.Phil 2015 (S.U)

QURESHI ALI, Assistant Professor

Pharm D 2011 (S.U), M.Phil 2017 (S.U)

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY

MAHESHWARI MADAN LAL, Assistant Professor (Study Leave)

B.Pharm 1998, M.Phil 2013 (S.U)

QURESHI YASMEEN, Lecturer

Pharm D 2011 (S.U)

KHAN TOOBA, Lecturer

Pharm D 2012 (S.U), M.Phil 2018 (S.U)

DEPARTMENT OF PHARMACOLOGY

DR. PANHWAR FOUZIA, Professor & Chairperson

B.Pharm.1993, M.Pharm, 1997 (S.U), Ph.D. 2012 (UK)

KHATRI MUHAMMAD AKRAM, Associate Professor

B.Pharm. 2005 (S.U), Ph.D. 2016 (South Korea)

MEMON MAZHAR MUSTAFA, Assistant Professor

B.Pharm. 2002 (S.U), M.Phil 2012 (Q.U)

KUMARI GEETA Assistant Professor

Pharm D 2009 (S.U), Ph.D. 2017 (Singapore)

SOLANGI MUHAMMAD ASLAM, Assistant Professor
Pharm.D 2008 (F.U), M.Phil 2013 (UoK), Ph.D. 2016 (UoK)

KHOKHAR MUHAMMAD ALI, Lecturer
Pharm D 2008 (S.U)

DEPARTMENT OF PHARMACOGNOSY

MEMON ABDUL HAKEEM, Professor & **Chairman**
B.Pharm. 2001 (S.U) M.Phil 2008 (S.U), Ph.D. 2016 (Malaysia)

SYED AHMED SHAH, Assistant Professor
B.Pharm 2006, Pharm.D[Condense Course] 2008 (S.U), Ph.D. 2017 (South Korea)

JAMALI JAMEELA, Lecturer
Pharm D 2010 (S.U)

DEPARTMENT OF PHARMACY PRACTICE

GHOTO MUHAMMAD ALI, Professor & **Chairman**
B. Pharm 1999, M.B.A 2005, M.A 2007, Ph.D. 2013 (SU)

ARAIN MUDASSAR IQBAL, Assistant Professor
Pharm D 2010 (S.U), Ph.D. 2016 (SU)

MANGI RABIA PARVEEN, Lecturer
Pharm D 2011 (S.U), Ph.D. 2019 (SU)

KUMAR NARENDAR, Lecturer
Pharm D 2011 (S.U)

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

- A. General Requirements (11)
 ENG 300, 301 English (2,4)
 IS 302 Islamic studies (3)
 PS 303 Pakistan studies (2)
- B. Professional Requirements (187)

1st Professional Pharm.D

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr.	Course No.	Subject	Cr. Hr.
ENG 300	English-A (Functional English)	2	ENG 301	English-B (Communication & Writing skills)	4
PHARM 310	Pharmaceutics-IA (Physical Pharmacy-I) Th.	3	PHARM 320	Pharmaceutics-IB (Physical Pharmacy-II) Th	3
PHARM 311	Pharmaceutics-IA (Physical Pharmacy-I)Lab	1	PHARM 321	Pharmaceutics-IB (Physical Pharmacy-II) Lab	1
PHARM 312	Pharmaceutical Chemistry-IA(Organic) Th	3	PHARM 322	Pharmaceutical Chemistry-IB (Organic) Th	3
PHARM313	Pharmaceutical Chemistry-IA(Organic) Lab	1	PHARM 323	Pharmaceutical Chemistry-IB (Organic)Lab	1
PHARM314	Pharmaceutical Chemistry-IIA (Biochemistry) Th	3	PHARM 324	Pharmaceutical Chemistry-IIB	3
PHARM315	Pharmaceutical Chemistry-IIA (Biochemistry) Lab	1	PHARM 325	Pharmaceutical Chemistry-IIB (Biochemistry) Lab	1
PHARM316	Physiology-A Th	3	PHARM 326	Physiology-B Th	3
PHARM317	Physiology-A Lab	1	PHARM 327	Physiology-B Lab	1
PHARM318	Anatomy & Histology Th	3			
PHARM319	Anatomy & Histology Lab	1			
Total Cr. Hr. 22			Total Cr. Hr. 20		

2nd Professional Pharm.D

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr	Course No.	Subject	Cr. Hr
IS 402	Islamic Studies	3	PS 403	Pakistan Studies	2
PHARM 410	Pharmaceutics-IIA (Dosage Form Science-I) Th	3	PHARM420	Pharmaceutics-IIB (Dosage Form Science-II)	3
PHARM 411	Pharmaceutics-IIA (Dosage Form Science-I) Lab	1	PHARM421	Pharmaceutics-IIB (Dosage Form Science-II)	1
PHARM 412	Pharmaceutics-IIIA (Pharmaceutical Microbiology & Immunology-I) Th	3	PHARM 422	Pharmaceutics-IIIB (Pharmaceutical Microbiology & Immunology-II) Th	3
PHARM 413	Pharmaceutics-IIIA (Pharmaceutical Microbiology & Immunology-I) Lab	1	PHARM 423	Pharmaceutics-IIIB (Pharmaceutical Microbiology & Immunology-II) Lab	1
PHARM 414	Pharmacology and Therapeutics-IA Th	3	PHARM 424	Pharmacology and Therapeutics-IB Th	3
PHARM 415	Pharmacology and Therapeutics-IA Lab	1	PHARM 425	Pharmacology and Therapeutics-IB Lab	1
PHARM 416	Pharmacognosy-IA (Basic) Th	3	PHARM 426	Pharmacognosy-IB (Basic) Th	3
PHARM 417	Pharmacognosy-IA (Basic) Lab	1	PHARM 427	Pharmacognosy-IB (Basic)Lab	1
PHARM 418	Pharmacy Practice-IA (Pharmaceutical Mathematics)	3	PHARM 428	Pharmacy Practice-IB (Bio-statistics)	3
Total Cr. Hr. 22			Total Cr. Hr. 21		

3rd Professional Pharm.D

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr	Course No.	Subject	Cr. Hr.
PHARM 510	Pharmacy Practice-IIA (Dispensing Pharmacy)	3	PHARM520	Pharmacy Practice-IIB (Community, Social & Administrative Pharmacy) Th	3
PHARM 511	Pharmacy Practice-IIA (Dispensing Pharmacy) Lab	1			
PHARM 512	Pharmaceutical Chemistry-IIIA (Pharmaceutical Analysis-I) Th	3	PHARM 522	Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis-II) Th	3
PHARM 513	Pharmaceutical Chemistry-IIIA (Pharmaceutical Analysis-I) Lab	1	PHARM523	Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis-II) Lab	1
PHARM 514	Pharmacology and Therapeutics-IIA Th	3	PHARM 524	Pharmacology and Therapeutics-IIB Th	3
PHARM 515	Pharmacology and Therapeutics-IIA Lab	1	PHARM525	Pharmacology and Therapeutics-IIB Lab	1
PHARM 516	Pharmacognosy-IIA (Advanced) Th	3	PHARM526	Pharmacognosy-IIB (Advanced) Th	3
PHARM 517	Pharmacognosy-IIA (Advanced) Lab	1	PHARM 527	Pharmacognosy-IIB (Advanced) Lab	1
PHARM 518	Pathology Th	3	PHARM528	Pharmacy Practice-III (Computer and its Applications in Pharmacy)	3
PHARM 519	Pathology Lab	1	PHARM 529	Pharmacy Practice-III (Computer and its Applications in Pharmacy)	1
Total Cr. Hr. 20			Total Cr. Hr. 19		

4th Professional Pharm.D

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr.	Course No.	Subject	Cr. Hr.
PHARM 610	Pharmacy Practice-IVA (Hospital Pharmacy-I)	3	PHARM 620	Pharmacy Practice-IVB (Hospital Pharmacy-II)	3
PHARM 612	Pharmacy Practice-VA (Clinical Pharmacy-I)	3	PHARM 622	Pharmacy Practice-VB (Clinical Pharmacy-II) Th	3
PHARM 613	Pharmacy Practice-VA (Clinical Pharmacy-I)	1	PHARM 623	Pharmacy Practice-VB (Clinical Pharmacy-II) Lab	1
PHARM 614	Pharmaceutics-IVA (Industrial Pharmacy-I) Th	3	PHARM 624	Pharmaceutics-IVB (Industrial Pharmacy-II) Th	3
PHARM 615	Pharmaceutics-IVA (Industrial Pharmacy-I) Lab	1	PHARM 625	Pharmaceutics-IVB (Industrial Pharmacy-II) Lab	1
PHARM 616	Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics-I) Th	3	PHARM 626	Pharmaceutics-VB (Biopharmaceutics & Pharmacokinetics-II) Th	3
PHARM 617	Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics-I) Lab	1	PHARM 627	Pharmaceutics-VB (Biopharmaceutics & Pharmacokinetics-II) Lab	1
PHARM 618	Pharmaceutics-VIA (Pharmaceutical Quality Management-I) Th	3	PHARM 628	Pharmaceutics-VIB (Pharmaceutical Quality Management-II) Th	3
PHARM 619	Pharmaceutics-VIA (Pharmaceutical Quality Management-I) Lab	1	PHARM 629	Pharmaceutics-VIB (Pharmaceutical Quality Management-II) Lab	1
Total Cr. Hr. 19			Total Cr. Hr. 19		

5th (Final) Professional Pharm. D

1st Semester			2nd Semester		
Course No.	Subject	Cr	Course No.	Subject	Cr. Hr.
PHARM 710	Pharmaceutics-VIIA Pharmaceutical Technology-I) Th	3	PHARM 720	Pharmaceutics- VIIB (Pharmaceutical Technology-II) Th	3
PHARM 711	Pharmaceutics-VIIA Pharmaceutical Technology-I) Lab	1	PHARM 721	Pharmaceutics- VIIB (Pharmaceutical Technology-II) Lab	1
PHARM 712	Pharmacy Practice-VIA (Advanced Clinical Pharmacy-I) Th	3	PHARM 722	Pharmacy Practice- VIB (Advanced Clinical Pharmacy-II)	3
PHARM 713	Pharmacy Practice-VIA (Advanced Clinical Pharmacy-II) Lab	1	PHARM 723	Pharmacy Practice- VIB (Advanced Clinical Pharmacy-II)	1
PHARM 714	Pharmacy Practice-VIIA (Forensic Pharmacy-I) Th	3	PHARM 724	Pharmacy Practice- VIIB (Forensic Pharmacy-II) Th	3
PHARM 716	Pharmacy Practice- VIIIA (Pharmaceutical Management & Marketing-I) Th	3	PHARM 726	Pharmacy Practice- VIIB (Pharmaceutical Management & Marketing-II) Th	3
PHARM 718	Pharmaceutical Chemistry-IVA (Medicinal Chemistry-I) Th	3	PHARM 728	Pharmaceutical Chemistry-IVB (Medicinal Chemistry-II) Th	3
PHARM 719	Pharmaceutical Chemistry-IVA (Medicinal Chemistry-I) Lab	1	PHARM 729	Pharmaceutical Chemistry-IVB (Medicinal Chemistry-II) Lab	1
Total Cr. Hr. 18			Total Cr. Hr. 18		

Pharm.D. Five-Year Credit Hours Summary:

Pharm.D. Professional	1st Semester Cr. Hr.	2nd Semester Cr. Hr.	Total Cr. Hr.
1 st	22	20	42
2 nd	22	21	43
3 rd	20	19	39
4 th	19	19	38
5 th (Final)	18	18	36
Total Credit Hours	101	97	198

SYLLABI AND SUBJECT OBJECTIVES

The learning and teaching strategy for every subject is based on the relevant syllabi and subject objectives as specified below with a view to ultimately achieve the pharmacy education objectives, and will involve as many principles of learning as possible.

A. Syllabi and subject objectives for basic subjects:

- 1. Remedial English:** On the whole in general in order to improve the language proficiency of science graduates a skill oriented, learner based four semester practical language course titled 'Remedial English has been introduced in Pharm. D. with following specific aims & objectives:
 - i. to equip the learners with required basic skills of English language through practice,
 - ii. to be able to communicate effectively in oral & written forms,
 - iii. to provide exposure opportunities to learners through involvement in practical situation,
 - iv. to comprehend the contextual ideas of speakers & books of various levels.
- 2. Islamic Studies and Pakistan Studies:** The applied aspects of the Islamic principles and Pakistan Studies are important. The time allotted for these subjects is utilized by inviting eminent scholars to speak on selected topics, conducting seminars and group discussions on moral values and practice in relation to medical and pharmaceutical sciences in the light of Islamic principles. The purpose is to bring positive behavioral changes in the students.
- 3. Anatomy:** In this subject emphasis is given to anatomy of different organs of human body. The students are familiarized with basic structures, location of different organs which play a role in the normal function of human body and applied aspects of developmental, gross and microscopic anatomy without burdening the students with unnecessary details of basic anatomy. Efforts are made to demonstrate anatomical facts of practical importance through models, prospected parts, films and slides. Also the teaching of developmental, gross and microscopic anatomy is taught concurrently.
- 4. Physiology:** Students are taught the general principles of functions of human body with emphasis on practical applications and basic physiological consideration of different systems of human body. Functional study of different organs and their inter-relationship and basic histological study of human cells and different organs is another important

objective. Experimental work in physiology illustrates important physiological concepts and measurements. Physiological phenomena is demonstrated practically by using modern equipment.

5. **Pathology:** The subject of pathology enables the students regarding:
 - i. Awareness of different diseases;
 - ii. Condition of diseases;
 - iii. Physiological variation in different diseases; and
 - iv. Hormonal Changes in different diseases.
6. **Mathematics:** Mathematics is the language of science. The study of mathematics is important as all the equations used in pharmacokinetics and pharmaco-dynamics are in the mathematical forms and studies of such results are in logarithmic and integration forms.
7. **Bio-statistics:** In pharmacy the statistical approach plays a key role in various aspects of research on drugs. The bioassay in drug development is to measure the potency of some new compounds relative to some standard drugs in terms of the magnitude of their effects. Statistics is used to test as many assumptions involved in the assay. Statistics is also required to design the clinical trials to obtain pharmaceutical information of any drug. The statistical approach is also used to estimate parameters. Statistics also helps in documenting the results of a study. The statistical approach is required for screening of compounds for clinically active drugs. The knowledge of statistics is also required for the study of the dose response relationship.
8. **Computer:** The students are required to learn basic introduction of computer with reference to their application in pharmacy.

B. Syllabi and subjects objectives for Pharmaceutics subjects:

1. **General Pharmaceutics:** This subject is taught to give the students an exposure about the basic terminologies used in pharmacy, basic techniques used in the field of pharmacy, knowledge about history and origin of pharmacy, different types of properties of pharmaceuticals and knowledge about physical processes used in pharmacy.
2. **Pharmaceutical Preparations:** The objective to teach pharmaceutical preparations is to give the students knowledge about different dosage forms used in pharmacy, their small and large scale preparation, formulation of different dosage forms, and their role in the practice of community pharmacy.
3. **Pharmaceutical dispensing, practice and pharmacy:** It is essential for a pharmacist to know while working in a pharmacy as how to prepare and supply medicines. This requires the knowledge of stability of medicines and their ingredients, principle of compounding, dosage, chemical, physical and therapeutic incompatibility, packaging methods, labeling procedures, legal requirements affecting drug storage, supply and records, containers and labeling of substances and misuse of drugs.
4. **Community Pharmacy:** The subject of community pharmacy is taught for giving the basic knowledge of different definitions and background of community pharmacy, importance of communication with patients, imparting knowledge about different methods used to control drug abuse and misuse and for identifying the role of pharmacist as public health educator in the community for drug monitoring and information.

5. **Hospital Pharmacy:** The objective is to educate the students about the real role of a pharmacist in hospital along with the roles that he/she is required to play in the distribution, storage and purchase of drugs in the hospital. The role of Pharmacy and Therapeutic Committee and the advantages of small scale manufacturing in hospital are highlighted.
6. **Clinical Pharmacy:** Clinical pharmacy is the practice of pharmacy in clinical setting especially in a hospital. The concept of clinical pharmacy and the role that the pharmacists are playing internationally is to be introduced. Study of clinical pharmacy is important in therapeutic drug monitoring, determining toxicities, drug interactions, adverse drug reactions and dosage regimen establishment. It helps in proper selection of drugs, administration route, as well as guiding patients about the drug therapy. The students need to learn the concept of rational use of drugs, essential drugs and their advantages, drug utilization evaluation and review, practical pharmacokinetics and the role of pharmacist in pharmaceutical care, its scope, management and application.
7. **Biopharmaceutics and Pharmacokinetics:** The concepts of bioavailability and administration, absorption, distribution, metabolism and excretion of drugs are required to study the drug pharmacokinetic parameters, dosage regime design, therapeutic drug monitoring, in-vivo evaluation of drugs and bioavailability studies. Also the studies relating for population pharmacokinetics, determination of frequency, duration and quantity of drugs given for particular disease and schedule of drugs in various ailments & in different age groups.
8. **Industrial Pharmacy:** By studying this subject, the students are able to understand that how different dosage forms at large scale are manufactured. Study of techniques for preparation of these dosage forms, latest advances in product formulation, techniques and technology for their production, is important for understanding the industrial pharmacy.
9. **Pharmaceutical quality management:** The concept of quality control and quality assurances is very important. The purpose is to educate the students about the understanding of the testing, quality control and methods adopted in a pharmaceutical industry for the dosage form control, process control, testing program and methods which include physical, chemical and biological tests and specifications and statistical quality control.
10. **Marketing and Management:** Pharmaceutical marketing and management enables the students to learn about different principles of management and marketing. This prepares the students as how to manage different tasks, planning of objectives, how to manage long term and short term targets in industry, marketing and retail set-ups, strategies to accomplish different goals and management of different tasks within a specified period of time.
11. **Forensic Pharmacy:** Study of this subject enable the students to become aware about the regulatory control of manufacturing and sale of drugs in Pakistan. The students are able to know about the laws and procedures regarding Registration and sale of drugs, establishment of retail, wholesale and distribution set ups. Knowledge of Rules and legislation about controlled, poisonous and dangerous drugs is also provided.
12. **Pharmaceutical Technology:** The students learn the techniques and methods of formulation development especially with reference to advanced formulation techniques, novel drug delivery systems, introduction of pharmaceutical bio-technology and role of pharmacist in the development of different useful biotechnological products.

- 13. Pharmaceutical Microbiology:** Students are taught the principles of Microbiology with special reference to Pharmaceutical Microbiology including environmental Microbiology and other relevant aspects. The modern concepts of microbiological application are taught to students. The staining of slides and preparation of culture media, etc., including microbiological assays of pharmaceuticals is also taught. Sensitivity test and other necessary pharmaceutical tests are also included. The students are trained about sterilization, disinfection and fermentation with reference to their use and application in the pharmaceutical industry. Knowledge of immune system is also imparted.

C. Syllabi and subjects objectives for Pharmaceutical chemistry:-

- 1. Biochemistry:** Students are taught those areas of biochemistry which are important for the understanding of metabolic disorders relevant to common disturbances of body functions, gene structure and functions. General introduction and basic biochemistry of proteins, carbohydrates, bioenergetics, lipids, etc., including biochemistry of enzymes and metabolic fate of nitrogen is also taught. The syllabus also includes replication and expression of genetic information. Metabolic basis of biochemistry in relation to human metabolism, digestion and intestinal absorption are also taught. Experimental work in biochemistry highlights the important clinical applications of biochemical tests. The use of modern equipment for biochemical analysis is demonstrated to the students.
- 2. Organic Chemistry:** By studying this subject, the students usually understand different organic reactions and their mechanisms. Knowledge about different organic molecules, their use in pharmacy and basic terms and techniques in organic chemistry are highlighted.
- 3. Pharmaceutical Instrumentation:** Study of this subject give knowledge about different techniques used for the estimation of drugs. Students are given the basic knowledge regarding the components of these techniques. They also learn the analysis of drugs by using latest techniques including theory and instrumentation of atomic absorption & emission spectroscopy, flame photometry, I.R., Mass, NMR, UV/Visible spectroscopy. It also includes the study of column, thin layer, gas-liquid chromatography, HPLC and GC-MS, potentiometry, polarography, radiochemical techniques and differential scanning calorimetry.
- 4. Medicinal Chemistry:** Study of this subject covers the theory of drug action, stereochemistry and drug action, alkaloids, vitamins and relation of structure and biological activity of organic medicinal agents. Protein and steroidal hormones, antibiotics, and synthetic drugs of different pharmacological activity are also included.

D. Syllabus and subject objectives for Pharmacognosy:

The study of Pharmacognosy is to give knowledge about crude drugs, their cultivation, evaluation and use etc. Different methods used for extraction and purification of crude drugs from different plant and animal source. The study includes medicinal plants of Pakistan, their habitat, collection and biological source of the drug. Allergens and allergenic preparations, enzymes, plant growth hormones as well as pesticides and poisonous plants with special reference to Pakistan shall are also included. Separation and isolation of plant constituents by special techniques like chromatography, ion exchange, electrophoresis and high performance liquid chromatography (HPLC) is introduced. Detailed study of carbohydrates and related products, alkaloids, volatile oils, fixed oils, tannins, glycosides, etc., is included. The students know the Unani system of medicine, phyto-pharmacology, Traditional Medicine and Alternative System of Medicine.

E. Syllabus and subject objectives for Pharmacology:

The teaching of Pharmacology is aimed at different aspects of drugs and pharmaceuticals used in different diseases. The therapeutic/pharmacological groups of drugs is taught according to the classification of World Health Organization. The students are able to know the relationship between drug concentration and biological response, drug action overtime, factors affecting absorption, distribution, binding, metabolism and elimination of chemicals, structure activity relationship, biological changes that result from repeated drug use, tolerance, addiction and adverse effects. Process of drug interaction with cellular macromolecules to alter physiological function and site of action including knowledge about proper selection of drugs is also covered.

F. Syllabus and Subject objectives for Pharmacy Practice:

The Department of Pharmacy Practice and Clinical Pharmacy is dedicated to enhancing pharmacy education, research and practice for improved patient care. To improve health, patient care and medication-related outcomes through education, clinical practice and research, accurately dispense medications, conduct sufficiently thorough and accurate patient assessments, explain and properly dispense commonly used medications, formulations, and drug products, identify and assess drug related problems relative to specific patient cases, appropriately utilize pharmaceutical and pharmacokinetics mathematics to perform accurate medication calculations, demonstrate appropriate ethical and professional behavior, and comply with all federal, state, and local laws related to pharmacy practice, demonstrate effective interpersonal, oral, and written communications skills with other health care professionals and patients, effectively communicate health and medication information to patients and/or care givers and provide effective counseling services as warranted, accurately assess the literature and other research resources to provide evidence-based drug information that meets the needs of patients and other health care providers. discuss how patients and care givers can obtain the most cost-efficient medications and related para-pharmaceuticals per patient-specific health insurance coverage options.

FACULTY OF PHARMACY

The faculty will comprise of the following departments with relevant subjects;

1. DEPARTMENT OF PHARMACEUTICS:

- Pharmaceutics-I (Physical Pharmacy)
- Pharmaceutics-II (Dosage Forms Science)
- Pharmaceutics-III (Pharmaceutical Microbiology & Immunology)
- Pharmaceutics-IV (Industrial Pharmacy)
- Pharmaceutics-V (Biopharmaceutics and Pharmacokinetics)
- Pharmaceutics-VI (Pharmaceutical Quality Management)
- Pharmaceutics-VII (Pharmaceutical Technology)

2. DEPARTMENT OF PHARMACEUTICAL CHEMISTRY:

- Pharmaceutical Chemistry-I (Organic Chemistry)
- Pharmaceutical Chemistry-II (Biochemistry)
- Pharmaceutical Chemistry-III (Pharmaceutical Analysis)
- Pharmaceutical Chemistry-IV (Medicinal Chemistry)

3. DEPARTMENT OF PHARMACOGNOSY:

- Pharmacognosy-I (Basic)
- Pharmacognosy-II (Advanced)

4. DEPARTMENT OF PHARMACOLOGY:

- Physiology
- Anatomy & Histology
- Pathology
- Pharmacology and Therapeutics-I (Basic)
- Pharmacology and Therapeutics-II (Advanced)

5. DEPARTMENT OF PHARMACY PRACTICE:

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

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

1st Professional Pharm.D .

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr.	Course No.	Subject	Cr. Hr.
ENG 300	English-A (Functional English)	2	ENG 301	English-B (Communication & Writing skills)	4
PHARM 310	Pharmaceutics-IA (Physical Pharmacy) Th.	3	PHARM 320	Pharmaceutics-IB (Physical Pharmacy) Th	3
PHARM 311	Pharmaceutics-IA (Physical Pharmacy) Lab	1	PHARM 321	Pharmaceutics-IB (Physical Pharmacy) Lab	1
PHARM 312	Pharmaceutical Chemistry-IA(Organic) Th	3	PHARM 322	Pharmaceutical Chemistry-IB (Organic) Th	3
PHARM 313	Pharmaceutical Chemistry-IA(Organic) Lab	1	PHARM 323	Pharmaceutical Chemistry-IB (Organic) Lab	1
PHARM 314	Pharmaceutical Chemistry-IIA (Biochemistry) Th	3	PHARM 324	Pharmaceutical Chemistry-IIB (Biochemistry) Th	3
PHARM 315	Pharmaceutical Chemistry-IIA (Biochemistry) Lab	1	PHARM 325	Pharmaceutical Chemistry-IIB (Biochemistry) Lab	1
PHARM	Physiology-A Th	3	PHARM 326	Physiology-B Th	3
PHARM	Physiology-A Lab	1	PHARM 327	Physiology-B Lab	1
PHARM	Anatomy & Histology Th	3			
PHARM	Anatomy & Histology Lab	1			
Total Cr. Hr. 22			Total Cr. Hr. 20		

2nd Professional Pharm.D

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr	Course No.	Subject	Cr. Hr
IS 402	Islamic Studies	3	PS 403	Pakistan Studies	2
PHARM 410	Pharmaceutics-IIA (Dosage Form Science) Th	3	PHARM 420	Pharmaceutics-IIB (Dosage Form Science) Th	3
PHARM 411	Pharmaceutics-IIA (Dosage Form Science) Lab	1	PHARM 421	Pharmaceutics-IIB (Dosage Form Science) Lab	1
PHARM 412	Pharmaceutics-IIIA (Pharmaceutical Microbiology & Immunology) Th	3	PHARM 422	Pharmaceutics-IIIB (Pharmaceutical Microbiology & Immunology) Th	3
PHARM 413	Pharmaceutics-IIIA (Pharmaceutical Microbiology & Immunology) Lab	1	PHARM 423	Pharmaceutics-IIIB (Pharmaceutical Microbiology & Immunology) Lab	1
PHARM 414	Pharmacology and Therapeutics-IA Th	3	PHARM 424	Pharmacology and Therapeutics-IB Th	3
PHARM 415	Pharmacology and Therapeutics-IA Lab	1	PHARM 425	Pharmacology and Therapeutics-IB Lab	1
PHARM 416	Pharmacognosy-IA (Basic) Th	3	PHARM 426	Pharmacognosy-IB (Basic) Th	3
PHARM 417	Pharmacognosy-IA (Basic) Lab	1	PHARM 427	Pharmacognosy-IB (Basic) Lab	1
PHARM 418	Pharmacy Practice-IA (Pharmaceutical Mathematics)	3	PHARM 428	Pharmacy Practice-IB (Bio-statistics)	3
Total Cr. Hr. 22			Total Cr. Hr.		

3rd Professional Pharm.D .

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr	Course No.	Subject	Cr. Hr.
PHARM 510	Pharmacy Practice-IIA (Dispensing Pharmacy) Th	3	PHARM 520	Pharmacy Practice-IIB (Community, Social & Administrative Pharmacy) Th	3
PHARM 511	Pharmacology and Therapeutics-IIA Lab	1			
PHARM 512	Pharmaceutical Chemistry-IIIA (Pharmaceutical Analysis) Th	3	PHARM 522	Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis) Th	3
PHARM 513	Pharmaceutical Chemistry-IIIA (Pharmaceutical Analysis) Lab	1	PHARM 523	Pharmaceutical Chemistry-IIIB (Pharmaceutical Analysis) Lab	1
PHARM 514	Pharmacology and Therapeutics-IIA Th	3	PHARM 524	Pharmacology and Therapeutics-IIB Th	3
PHARM 515	Pharmacology and Therapeutics-IIA Lab	1	PHARM 525	Pharmacology and Therapeutics-IIB Lab	1
PHARM 516	Pharmacognosy-IIA (Advanced) Th	3	PHARM 526	Pharmacognosy-IIB (Advanced) Th	3
PHARM 517	Pharmacognosy-IIA (Advanced) Lab	1	PHARM 527	Pharmacognosy-IIB (Advanced) Lab	1
PHARM 518	Pathology Th	3	PHARM 528	Pharmacy Practice-III (Computer and its Applications in Pharmacy) Th	3
PHARM 519	Pathology Lab	1	PHARM 529	Pharmacy Practice-III (Computer and its Applications in Pharmacy) Lab	1
Total Cr. Hr. 20			Total Cr.		

4th Professional Pharm.D

1 st Semester			2 nd Semester		
Course No.	Subject	Cr. Hr	Course No.	Subject	Cr. Hr
PHARM 610	Pharmacy Practice-IVA (Hospital Pharmacy)	3	PHARM 620	Pharmacy Practice-IVB (Hospital Pharmacy)	3
PHARM 612	Pharmacy Practice-VA (Clinical Pharmacy) Th	3	PHARM 622	Pharmacy Practice-VB (Clinical Pharmacy) Th	3
PHARM 613	Pharmacy Practice-VA (Clinical Pharmacy) Lab	1	PHARM 623	Pharmacy Practice-VB (Clinical Pharmacy) Lab	1
PHARM 614	Pharmaceutics-IVA (Industrial Pharmacy) Th	3	PHARM 624	Pharmaceutics-IVB (Industrial Pharmacy) Th	3
PHARM 615	Pharmaceutics-IVA (Industrial Pharmacy) Lab	1	PHARM 625	Pharmaceutics-IVB (Industrial Pharmacy) Lab	1
PHARM 616	Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics) Th	3	PHARM 626	Pharmaceutics-VB (Biopharmaceutics & Pharmacokinetics) Th	3
PHARM 617	Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics) Lab	1	PHARM 627	Pharmaceutics-VB (Biopharmaceutics & Pharmacokinetics) Lab	1
PHARM 618	Pharmaceutics-VIA (Pharmaceutical Quality Management) Th	3	PHARM 628	Pharmaceutics-VIB (Pharmaceutical Quality Management) Th	3
PHARM 619	Pharmaceutics-VA (Biopharmaceutics & Pharmacokinetics) Lab	1	PHARM 629	Pharmaceutics-VIB (Pharmaceutical Quality Management) Lab	1
Total Cr. Hr.			Total Cr. Hr. 19		

5th (Final) Professional Pharm. D

1st Semester			2nd Semester		
Course No.	Subject	Cr	Course No.	Subject	Cr. Hr
PHARM 710	Pharmaceutics-VIIA Pharmaceutical Technology) Th	3	PHARM 720	Pharmaceutics- VIIB (Pharmaceutical Technology) Th	3
PHARM 711	Pharmaceutics-VIIA Pharmaceutical Technology) Lab	1	PHARM 721	Pharmaceutics- VIIB (Pharmaceutical Technology) Lab	1
PHARM 712	Pharmacy Practice-VIA (Advanced) Th	3	PHARM 722	Pharmacy Practice- VIB (Advanced) Th	3
PHARM 713	Pharmacy Practice-VIA (Advanced) Lab	1	PHARM 723	Pharmacy Practice- VIB (Advanced) Lab	1
PHARM 714	Clinical Pharmacy-II) Pharmacy Practice-VIIA (Forensic Pharmacy) Th	3	PHARM 724	Clinical Pharmacy-II) Pharmacy Practice-VIIB (Forensic Pharmacy) Th	3
PHARM 716	Pharmacy Practice- VIIIA (Pharmaceutical Management & Marketing) Th	3	PHARM 726	Pharmacy Practice- VIIB (Pharmaceutical Management & Marketing) Th	3
PHARM 718	Pharmaceutical Chemistry-IVA (Medicinal Chemistry) Th	3	PHARM 728	Pharmaceutical Chemistry-IVB (Medicinal Chemistry) Th	3
PHARM 719	Pharmaceutical Chemistry-IVA (Medicinal Chemistry) Lab	1	PHARM 729	Pharmaceutical Chemistry-IVB (Medicinal Chemistry) Lab	1
Total Cr. Hr.			Total Cr.		

Pharm.D. Five-Year Credit Hours Summary:

Pharm.D.	1 st Semester	2 nd Semester	Total
Professional	Cr. Hr.	Cr. Hr.	Cr. Hr.
1 st	22	20	42
2 nd	22	21	43
3 rd	20	19	39
4 th	19	19	38
5 th (Final)	18	18	36
Total Credit Hours	101	97	198

DETAILS OF COURSES (SEMESTER SYSTEM)

FIRST PROFESSIONAL

FIRST SEMESTER

ENGLISH-A (FUNCTIONAL ENGLISH)

ENG 300

Marks: 100

Cr. Hr. 02

Objectives: Enhance language skills and develop critical thinking.

Course Contents:

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

NOTE: Extensive reading is required for vocabulary building.

Recommended Books:

Functional English:

Grammar:

1. Thomson AJ, Martinet AV. **Practical English grammar.** 3rdEd.OxfordUniversity Press; 1986.

Writing:

2. Kirszner LG, Mandell SR. **Patterns of College Writing:** A Rhetorical Reader and Guide. 10th Ed. Stephen Martin's Press; 2006.
3. Maley A. **Oxford supplementary skills:** 1st Ed. Writing Intermediate. Cornelsen & OxfordUniversity Press; 1998.

Reading/Comprehension:

4. Langan J. **Reading and Study Skills.** 9th Ed. McGraw Hill Humanities; 2009.

Speaking:

5. Nolasco R. **Speaking: Elementary:** Oxford Supplementary Skills. 4thEd.OxfordUniversity Press; 1987.

1. PHARMACY ORIENTATION:

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

2. HISTORY AND LITERATURE OF PHARMACY:

- a. A survey of the history of pharmacy through ancient Greek and Arab periods with special reference to contribution of Muslim scientists to pharmacy and allied sciences.
- b. An introduction of various official books.

3. PHYSICO-CHEMICAL PRINCIPLES:

- a. Solutions: Introduction, types, concentration expressions, ideal and real solution, colligative properties, their mathematical derivations and applications in pharmacy, molecular weight determinations, distribution co-efficient and its applications in pharmacy.
- b. Solubilization: Factors affecting solubility. Surfactants, their properties and types. Micelles; their formulation and types.
- c. Adsorption: Techniques and processes of adsorption in detail.
- d. Ionization: pH, pH indicators, pka, buffers, buffer's equation, isotonic solutions and their applications in pharmacy.
- e. Hydrolysis: Types and protection of drugs against hydrolysis.
- f. Micromeritics: Particle size, shapes and distribution of particles. Methods of determination of particle size and importance of particle size in Pharmacy.

1. DISPERSIONS:

- a. Colloids: Types, methods of preparation, properties (optical, kinetic, electrical). Dialysis and artificial kidney, stability of colloids, protection and sensitization phenomenon and application of colloids in Pharmacy.
- b. Emulsions: Types, theories of emulsification, emulsifying agents their classification and stability of emulsion.
- c. Suspensions: Type, Methods of Preparation, Properties, Suspending agents, their classification and stability.

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

Recommended Books:

PHYSICAL PHARMACY

1. Allen LV, Popovich NG. **Ansel's pharmaceutical dosage forms and drug delivery systems**. 8th Ed. Lippincott Williams & Wilkins New York; 2005.
2. Attwood D, Floccence AT. **Surfactant Systems: Their Chemistry, Pharmacy and Biology**. 1st Ed. London: Chapman and Hall Ltd; 1982.
3. Aulton ME. **Aulton's pharmaceuticals: the design and manufacture of medicines**. Churchill Livingstone; 2007.
4. Britain MD. **British national formulary**. 54th Ed. British Medical Association; 2001.
5. Carstensen JT. **Pharmaceutics of solids and solid dosage forms**. 1st Ed. Wiley; 1977.
6. Connors KA, Mecozzi S. **Thermodynamics of pharmaceutical systems: An introduction to Theory and Applications**. 2nd Ed. Wiley & Sons; 2010.
7. Cooper JW, Gunn C, Carter SJ. **Cooper and Gunn's Tutorial Pharmacy**. 6th Ed. New Delhi: CBS Publishers & Distributors; 2004.
8. Davis H. **Bentley's Text Book of Pharmaceutics**. 2nd Ed. Tindall and Cox Publishers; 1961.
9. Finlay WH. **The mechanics of Inhaled pharmaceutical aerosols: An introduction**. 1st Ed. Academic Press; 2001.
10. Florence AT, Attwood D. **Physicochemical Principles of Pharmacy**. 5th Ed. Pharmaceutical Press; 2011.
11. Florence AT, Siepmann J. **Moderen Pharmaceutics: Basic Principles and Systems: (Drugs and the Pharmaceutical Sciences)**. 5th Ed. Taylor & Francis; 2008.
12. Ganderton D, Jones T, McGinity J. **Advances in Pharmaceutical Sciences**. 1st Ed. Academic Press; 1995.
13. Ghosh TK, Jasti BR. **Theory and practice of contemporary pharmaceuticals**. 1st Ed. CRC Press; 2005.
14. Kleemann A, Engel J, Kutscher B, Reichert D. **Pharmaceutical substances: Syntheses, Patents, Applications of the most relevant APIs**. 5th Ed. Thieme; 2008.
15. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical experimental design: (Drugs & the Pharmaceutical Sciences)**. 1st Ed. Informa HealthCare; 1998.
16. Lund W. **The pharmaceutical Codex: Principles and practice of pharmaceuticals**. 16th Ed. Co CBS Publishers; 2009.
17. Rienger M, Scott-Blair GW. **Rheology**. 3rd Ed. Academic Press; 1990.
18. Rowe RC, Sheskey PJ, Quinn ME. **Handbook of pharmaceutical excipients**. 6th Ed. Pharmaceutical Press; 2009.
19. Sinko PJ, Martin AN. **Martin's physical pharmacy and pharmaceutical sciences: physical chemical and biopharmaceutical principles in the pharmaceutical sciences**. 5th Ed. Lippincott Williams & Wilkins; 2006.
20. Sinko PJ. **Martin's Physical Pharmacy and Pharmaceutical Sciences**. 6th Ed. Lippincott Williams & Wilkins; 2010.
21. Winfield AJ, Richards RME. **Pharmaceutical practice**. Elsevier Health Sciences; 2004.
22. Zinc G. **Remington: The Science and Practice of Pharmacy**. Philadelphia College of Pharmacy and Science; 2005.

PHARMACEUTICAL CHEMISTRY-IA (ORGANIC)

PHARM 312

Marks: 100

[THEORY]

Cr. Hr. 03

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

1. **BASIC CONCEPTS:** Chemical Bonding and concept of Hybridization, Conjugation, Resonance (Mesomerism), Hyperconjugation, Aromaticity, Inductive effect, Electromeric effect, Hydrogen bonding, Steric effect, Effect of structure on reactivity of compounds, Tautomerism of Carbonyl Compounds, Nomenclature of Organic Compounds.
2. **STEREOCHEMISTRY/ CONFORMATIONAL ANALYSIS:** Stereoisomerism, optical isomerism; Molecules with more than one chiral centre, Geometrical isomerism, Resolution of racemic mixture, Conformational analysis.
3. **GENERAL METHODS OF PREPARATION, PROPERTIES, IDENTIFICATION TEST AND PHARMACEUTICAL APPLICATIONS OF THE FOLLOWING CLASSES AND THEIR ANALOGUES:**
 - i. Alkane, Alkenes, Alkynes, Aromatic compounds
 - ii. Alkyl halide, Alcohol, phenols, ethers, amines
 - iii. Ketones, Aldehydes
 - iv. Acids, Esters, Amides and derivatives
4. **NUCLEOPHILIC, ELECTROPHILIC SUBSTITUTION REACTION IN ALIPHATIC AND AROMATIC SYSTEMS:**
5. **ORIENTATION IN ELECTROPHILIC SUBSTITUTION REACTIONS ON BENZENE RING:**

PHARMACEUTICAL CHEMISTRY-IA (ORGANIC)

PHARM 313

Marks: 50

[PRACTICAL]

Cr.Hr.01

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Organic analysis: Identification of unknown simple organic compounds.

Recommended Books:**PHARMACEUTICAL CHEMISTRY (ORGANIC)**

1. Bansel RK. **Organic Reaction Mechanism.** 3rd Ed. Tata McGraw Hill; 1992.
2. Bhal BS. **Textbook of Organic Chemistry.** 16th Ed. S. Chand & Co; 2007.
3. Block JH, Beale JM. **Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry.** 20th Ed. Lippincott Williams & Wilkins; 2010.
4. Eliel EL, Wilen SH. **Stereochemistry of Carbon Compounds.** 1st Ed. Tata McGraw Hill; 1994.
5. Finar IL. **Organic Chemistry.** 6th Ed. Person Education Asia; 2001.
6. Roberts JD, Caserio MC. **Basic Principles of organic Chemistry.** 3rd Ed. Addison Wesley; 1990.
7. Sykes P. **Guide Book to Mechanism in Organic Chemistry.** 6th Ed. Longman Co;

1991. Vogel AI, Tatchell AR, Furnis BS, Hannaford AJ, Smith PWG. **Vogel's Textbook of Practical Organic Chemistry**. 5th Ed. Pearson Education Limited; 1996.

8. Wade LG. **Organic Chemistry**. 7th Ed. Prentice Hall; 2010.

PHARMACEUTICAL CHEMISTRY-IIA (BIOCHEMISTRY) [THEORY]
PHARM 314 Marks: 100 Cr. Hr. 03

1. **GENERAL INTRODUCTION AND BASIC BIOCHEMICAL PRINCIPLES:** Role of Pharmaceutical Biochemistry in the health profession. Nature of biochemical reactions.
2. **BASIC CHEMISTRY OF BIOMOLECULES:** (Nature, Classification etc.)
 - a) **Carbohydrates:** Chemistry, Classification, Reactions of Carbohydrates, Optical activity, Biological and pharmaceutical importance of carbohydrates.
 - b) **Lipids:** Chemistry of Fatty acids and Lipids, Classification (Saponifiable and non-saponifiable lipids, Simple, Complex and Derived lipids), Reactions of Fatty acids and other Lipids, Essential fatty acids, Biological and pharmaceutical importance of lipids.
 - c) **Proteins and Amino acids:** Chemistry, Classification of proteins and amino acids, Reactions of proteins and amino acids, Organizational levels, Macromolecular nature of proteins, Biological and pharmaceutical importance of proteins and amino acids.
 - d) **Nucleic Acids:** Chemistry, Types (DNA, RNA, mRNA, tRNA, rRNA), Purine and Pyrimidine bases, Nucleosides, Nucleotides, Structures of nucleic acids, Biological and pharmaceutical importance of nucleic acids.
 - e) **Vitamins:** Chemistry, Classification (Fat-soluble and water-soluble vitamins), Biological and pharmaceutical importance of vitamins.
 - f) **Hormones:** Chemistry, Classification (Proteinous and nonproteinous hormones, amino acid derivatives, steroids), Biological and pharmaceutical importance of hormones.
 - g) **Enzymes:** Chemistry, Classification, Mode of action, Kinetics (Michaelis Menten Equation and some modifications), Inhibition, Activation, Specificity, Allosteric enzymes, Factors affecting the rate of an enzyme-catalyzed reaction, Biological and pharmaceutical importance, Mechanism of action of some important enzymes (Chymotrypsin, Ribonuclease).

PHARMACEUTICAL CHEMISTRY-IIA (BIOCHEMISTRY)
[PRACTICAL]
PHARM 315 Marks: 50 Cr. Hr. 01

1. **Qualitative analysis of:** Carbohydrates, Amino acids, Peptides and Sugar, Uric acid, Proteins, Lipids and Sterols (Cholesterol). Bile salts, Billirubin, Analysis of Cholesterol and Creatinine in Blood.
2. **Quantitative analysis of:** Carbohydrates-Glucose (reducing sugar) and any other carbohydrate using Benedict and Anthrone method, Amino acids, Peptides and Proteins using Biuret and Ninhydrin (Spectrophotometric) method. Analysis of normal and abnormal components of

Urine-Sugar, Uric acid, Billirubin, Cholesterol and Creatinine.

Recommended Books:

PHARMACEUTICAL CHEMISTRY (BIOCHEMISTRY)

1. Berg JM, Tymoczko JL, Stryer L. **Biochemistry**. 7th Ed. WH Freeman and Company; 2010.
2. Bishop ML, Fody EP, Schoeff LE. **Clinical Chemistry: Techniques, Principles and Correlations**. 6th Ed. Lippincott Williams & Wilkins; 2009.
3. Champe PC, Harvey RA. **Illustrated Biochemistry**. 4th Ed. Lippincot Company; 2007.
4. Chaterjee MN. **Medical Biochemistry**. 7th Ed. Jaypee Brothers Medical Publishers; 2007.
5. Conn EE, Stumpf PK. **Outlines of Biochemistry**. 5th Ed. John Willey & Sons; 1999.
6. Lehninger AL. **Principles of Biochemistry**. 4th Ed. CBS Publisher; 2004.
7. Murray R, Rodwell V, Bender D, Kathleen M, Botham P, Weil A et al. **Harper's Illustrated Biochemistry**. 28th Ed. Print-Hall; 2009.
8. West ES, Todd RW, Van BTJ. **Text Book of Biochemistry**. The MacMillan Co; 1996.

PHYSIOLOGY-A
PHARM 316

Marks:100

[THEORY]
Cr. Hr. 03

Course Objective:

After the completion of this course the students should be able to describe all the basic physiological processes which are the basis of pathophysiology of various diseases and their ultimate link with pharmacology for their treatment.

1. BASIC CELL FUNCTIONS:

- a. Chemical composition of the body: Atoms, Molecules, Ions, Free Radicals, Polar Molecules, Solutions, Classes of Organic Molecules
- b. Cell structure: Microscopic Observation of Cell, Microscopic, Cell Organelles, Cytoskeleton.
- c. Protein activity and cellular metabolism: Binding Site Characteristics, Regulation of Binding site Characteristics, Chemical Reactions, Enzymes, Regulation of Enzyme Mediated Reactions, Multienzyme metabolic Pathways, ATP, Cellular Energy Transfer, Carbohydrate, Fat, and Protein Metabolism, Essential Nutrients.
- d. Genetic information and Protein Synthesis: Genetic Code, Protein Synthesis, Protein, Degradation, Protein Secretion, Replication and Expression of Genetic Information, Cancer, Genetic Engineering.
- e. Movement of Molecules across Cell Membranes: Diffusion, Mediated Transport Systems, Osmosis, Endocytosis and Exocytosis, Epithelial Transport.

2. BIOLOGICAL CONTROL SYSTEM:

- a. Homeostatic Mechanisms and Cellular Communication General Characteristics,

- Components of Homeostatic Control Systems, Intercellular Chemical Messengers, Processes Related to Homeostasis, Receptors, Single Transduction Pathways.
- b. Neural Control Mechanisms: Structure and Maintenance of Neurons, Functional Classes of Neurons, Glial Cells, Neural Growth and Regeneration, Basic Principles of Electricity, The resting Membrane Potential, Graded Potentials and Action Potentials, Functional Anatomy of synapses, Activation of the Postsynaptic Cell, Synaptic Effectiveness, Neurotransmitters and Neuromodulators, Neuroeffector communication, Central Nervous System: Spinal Cord Central Nervous System: Brain, Peripheral Nervous System, Blood Supply, Blood-Brain Barrier Phenomenon, and Cerebrospinal fluid.
 - c. The Sensory Systems: Receptors, Neural Pathways in Sensory System, Association Cortex and Perceptual Processing, Primary Sensory Coding, Somatic Sensation, Visio, Hearing, Vestibular System, Chemical Senses.
 - d. Principles of Hormonal Control Systems: Hormone Structures and Synthesis, Hormone Transport in the Blood, Hormone Metabolism and Excretion, Mechanisms of Hormone Action, Inputs that control Hormone Secretion, Control Systems Involving the Hypothalamus and Pituitary, candidate Hormones, types of Endocrine Disorders.
 - e. Muscle: Structure, Molecular Mechanisms of Contraction, Mechanics of Single fiber Contraction, Skeletal Muscle Energy Metabolism, Types of Skeletal Muscle Fibers, Whole Muscle Contraction, Structure, Contraction and its Control.
 - f. Control of Body Movement: Motor Control Hierarchy, Local control of Motor Neurons, The Brain Motor Centers and the Descending Pathways they Control, Muscle Tone, Maintenance of Upright Posture and Balance, Walking.
 - g. Consciousness and Behavior: State of consciousness, conscious Experiences, Motivation and Emotion, Altered State of Consciousness, Learning and Memory, Cerebral Dominance and language Conclusion.

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

PHYSIOLOGY-A

PHARM 317

Marks:50

[PRACTICAL]

Cr. Hr. 03

NOTE: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities e.g. Experimental Physiology includes:

1. NEURAL CONTROL MECHANISM: Nerve muscle preparation in frog; Effect of Temperature on muscle and Demonstration of spinal reflexes.
2. SENSORY SYSTEM: Visual activity, far vision, near vision and Field of vision (Perimetry). Hearing and Vestibular system.

Recommended Books:

PHYSIOLOGY

1. Chatterjee CC. **Human Physiology**. 9th Ed. Medical Allied Agency; 1994.
2. Cyril A, Neil E, Joels N. **Samson Wright's Applied Physiology**. 13thEd.OxfordUniversity Press; 1992.
3. Guyton AC. **Text Books of Medical Physiology**. 9th Ed. W B Saunders Company; 2011.
4. Kuntzman AJ, Tortora GJ. **Anatomy and physiology for the manual therapies**. 1st Ed. John Wiley & Sons; 2009.
5. Martini F. **Fundamentals of anatomy and physiology**. 8th Ed. Prentice Hall; 2010.
6. SaladinKS, Miller L. **Anatomy & physiology: The Unity of Form and Function**. 6th Ed. McGraw-Hill; 1998.
7. Snell RS. **Clinical Anatomy for Medical Students**. 1st Ed. Litle Brown & CoInc; 1992.
8. Spence AP, Elliot B, Mason EB. **Human Anatomy and Physiology**. 3rd Ed. West Publishing Company; 1992.
9. Stuart Ira. **Human Physiology**. 11th Ed. Fox; 2008.
10. Tortora GJ, Derrickson B. **Principles of anatomy and physiology**. 13th Ed. Wiley; 2010.
11. Widmaier E, Raff H, Strang K. **Vander's Human Physiology**. 12th Ed. McGraw Hill; 2010.
12. William F, Ganong WF. **Review of Medical physiology**. 22nd Ed. Prentice Hall International Inc; 2005.

ANATOMY & HISTOLOGY
PHARM 318

Marks:100

[THEORY]
Cr.Hr. 03

Course Objectives: After the completion of this course the students should be able to understand the basic structure of various organs of our body not only at gross level but also at tissues or cell level.

1. **INTRODUCTION:** ANATOMICAL TERMINOLOGY: Definition. Cell, tissue, organ system.
2. **STRUCTURE OF CELL:** Cell Membrane, Cytoplasm, Organelles, Nucleus, Cell cycle.
3. **TISSUES OF BODY:**Types of tissues with examples,
 - a. Epithelial Tissue: General characters, classification.
 - b. Connective Tissue: Structure & types; (Connective tissue, Cartilage).
 - c. Bones: Structure and types of bones and joints.
 - d. Muscle: Structure of skeletal muscle, smooth muscle, cardiac muscle.
4. **INTEGUMENTARY SYSTEM:**
 - a. Skin: Structure (Epidermis, dermis).
 - b. Glands of Skin: (Sweat, Sebaceous).
 - c. Hair: Structure, function.
 - d. Nail: Structure, function
5. **CARDIOVASCULAR SYSTEM:**
 - a. Heart: Structure of Heart, Location of Heart, Blood Supply to Heart.
 - b. Blood Vessels: Main blood vessels arising & entering the heart. Types of blood vessels with examples.
6. **ALIMENTARY SYSTEM:** Name and structure of different parts of alimentary system and their inter-relationship.

7. **URINARY SYSTEM:** Name and structure of organs of urinary system and their inter-relationship.
8. **REPRODUCTIVE SYSTEM:** Male and Female reproductive systems. Name, structure and association of the organs.
9. **ENDOCRINE SYSTEM:**
 - a. Pituitary gland: structure and relation to hypothalamus.
 - b. Thyroid gland: structure.
 - c. Adrenal gland: structure.
10. **NERVOUS SYSTEM:** Introduction: Cells of Nervous System (Neuron), Accessory cells of N.S. and Organization of N.S.
 - a. Brain: Meninges (Cerebrum: cerebral Lobes. Ventricles, Cerebellum— Anatomy of Cerebellum, Brain Stem: MidBrain. Pons. MEDulla Oblongata, Diencephalon. Thalamus Hypothalamus and Cranial Nerves).
 - b. Spinal Cord: Meninges (C.S.F. Internal Structure, Sensory and Motor Pathway, Spinal Reflexes, Peripheral spinal Nerves, Autonomic Nervous System includes Sympathetic N.S. and Parasympathetic Nervous System).
11. **HISTOLOGY:**
 - a. Underlying principles of histological techniques and staining specific tissues should be explained.
 - b. Staining of paraffin and frozen sections will be given to the students.
 - c. Most of the teaching should be done on stained and mounted sections and every type of normal tissue will be covered.

ANATOMY & HISTOLOGY
PHARM 319

Marks:50

[PRACTICAL]
Cr.Hr. 01

1. Demonstration of the Preparation and staining of slides.
2. Histological examination of slides: Epithelium, Muscle tissue and Connective tissue.
3. Organ system: Lung, Kidney, Stomach, Appendix, Skin, Intestine and Gall bladder.

Recommended Books:

ANATOMY & HISTOLOGY

Anatomy

1. Drake RL, VoglWA, Mitchell AWM. **Gray's Anatomy:** Descriptive and Applied. 2nd Ed. Churchill Living Stone; 2009.
2. Grant B. **A Method of Anatomy.** 9th Ed. Bailliere Tinal and Co Ltd; 1975.
3. Hamilton WJ. **A Textbook of Anatomy.** 2nd Ed. Macmillan and Co; 1976.
4. Kuntzman AJ, Tortora GJ. **Anatomy and physiology for the manual therapies.** 1st Ed. John Wiley & Sons; 2009.
5. Last RJ. **Anatomy:** Regional and Applied. 11th Ed. J and A Churchill Ltd; 2001.
6. Martini F, Ober WC, Garrison CW, Welch K, Hutchings RT. **Fundamentals of Anatomy and Physiology.** 5th Ed. Prentice Hall; 2001.
7. Moore KL, Dalley AF, Agur AMR. **Clinically Oriented Anatomy.** 6th Ed. Lipponcott Williams and Wilkin; 2009.

8. Romanes GJ. **Cunningham's Manual of Practical Anatomy.** 15thEd.OxfordUniversity Press; 1986.
9. SaladinKS, Miller L. **Anatomy & physiology: The Unity of Form and Function.** 6th Ed. McGraw Hill; 1998.
10. Snell RS. **Clinical Anatomy.** 7th Ed. Boston Little Brown and Company; 2003. 11. Standing S. **Gray's anatomy: The Anatomical Basis of Clinical Practice.** 40th Ed. Churchill Livingstone; 2008.
12. **Tissues of the body by Legros Clerks.** Publisher Oxford at the Clarendon Press, London.
13. Tortora GJ, Derrickson B. **Principles of anatomy and physiology.** 13th Ed. Wiley; 2010.

Histology

1. Cormack HD. **Essentials of Histology.** 2nd Ed. JB Lippincott Co; 1993.
2. Hammersen F. **Histology: Color atlas of microscopic anatomy.** 3rd Ed. Lee & Febijer Co; 1985.
3. Hewer EE, Bradbury S. **Textbook of Histology for Medical Students.** 9th Ed. William Heinemann Medical Books Ltd; 1973.

SECOND SEMESTER

ENGLISH-B (COMMUNICATION, WRITING & TECHNICAL PRESENTATION SKILLS)
ENG 301

Marks:100

Cr.Hr.04

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

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

Translation skills: Urdu to English.

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

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

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

Essay writing: Descriptive, narrative, discursive, argumentative. Technical Report writing: Pharmacy writing and oral communication.

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

Recommended Books:

Communication Skills:

Reading/Comprehension:

1. Tomlinson B, Ellis R. **Reading Advanced.** Oxford Supplementary Skills. 3rdEd.OxfordUniversity Press; 1992.

Technical Writing and Presentation Skills:

Essay Writing and Academic Writing;

2. LanganJ.**College Writing Skills with Readings.** 8th Ed. McGraw Hill; 2010.

Presentation Skills;

3. Gilbert MD. **English for Pharmacy writing and oral communication.** 1st Ed. Lippincott Williams & Wilkins; 2008.

Reading;

4. Neulib J, CainKS, Ruffus S, Scharton M. **The Mercury Reader:** A custom publication. 4th Ed. Pearson; 2011.
5. White R. **Advanced:** Oxford Supplementary Skills. 3rdEd.OxfordUniversity Press; 1992.
6. Wong L. **Essential Study Skills.** 7th Ed. Wadsworth Publishing; 2011.

PHARMACEUTICS-IB (PHYSICAL PHARMACY) [THEORY] PHARM 320

- Churchill Livingstone; 2007.
4. Britain MD. **British national formulary**. 54th Ed. British Medical Association; 2001.
 5. Carstensen JT. **Pharmaceutics of solids and solid dosage forms**. 1st Ed. Wiley; 1977.
 6. Connors KA, Mecozzi S. **Thermodynamics of pharmaceutical systems: An introduction to Theory and Applications**. 2nd Ed. Wiley & Sons; 2010.
 7. Cooper JW, Gunn C, Carter SJ. **Cooper and Gunn's Tutorial Pharmacy**. 6th Ed. New Delhi: CBS Publishers & Distributors; 2004.
 8. Davis H. **Bentley's Text Book of Pharmaceutics**. 2nd Ed. Tindall and Cox Publishers; 1961.
 9. Finlay WH. **The mechanics of Inhaled pharmaceutical aerosols: An introduction**. 1st Ed. Academic Press; 2001.
 10. Florence AT, Attwood D. **Physicochemical Principles of Pharmacy**. 5th Ed. Pharmaceutical Press; 2011.
 11. Florence AT, Siepmann J. **Moderen Pharmaceutics: Basic Principles and Systems: (Drugs and the Pharmaceutical Sciences)**. 5th Ed. Taylor & Francis; 2008.
 12. Ganderton D, Jones T, McGinity J. **Advances in Pharmaceutical Sciences**. 1st Ed. Academic Press; 1995.
 13. Ghosh TK, Jasti BR. **Theory and practice of contemporary pharmaceutics**. 1st Ed. CRC Press; 2005.
 14. Kleemann A, Engel J, Kutscher B, Reichert D. **Pharmaceutical substances: Syntheses, Patents, Applications of the most relevant APIs**. 5th Ed. Thieme; 2008.
 15. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical experimental design: (Drugs & the Pharmaceutical Sciences)**. 1st Ed. Informa HealthCare; 1998.
 16. Lund W. **The pharmaceutical Codex: Principles and practice of pharmaceutics**. 16th Ed. Co CBS Publishers; 2009.
 17. Rienger M, Scott-Blair GW. **Rheology**. 3rd Ed. Academic Press; 1990.
 18. Rowe RC, Sheskey PJ, Quinn ME. **Handbook of pharmaceutical excipients**. 6th Ed. Pharmaceutical Press; 2009.
 19. Sinko PJ, Martin AN. **Martin's physical pharmacy and pharmaceutical sciences: physical chemical and biopharmaceutical principles in the pharmaceutical sciences**. 5th Ed. Lippincott Williams & Wilkins; 2006.
 20. Sinko PJ. **Martin's Physical Pharmacy and Pharmaceutical Sciences**. 6th Ed. Lippincott Williams & Wilkins; 2010.
 21. Winfield AJ, Richards RME. **Pharmaceutical practice**. Elsevier Health Sciences; 2004.
 22. Zinc G. **Remington: The Science and Practice of Pharmacy**. Philadelphia College of Pharmacy and Science; 2005

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

1. **HETEROCYCLIC CHEMISTRY:**

- i. Preparation and properties of medicinally important Heterocyclic Compounds such as pyrol, furan, thiophene, pyridine, pyrimidine and pyrazine.
- ii. Preparation and properties of heterocyclic compounds in which benzo-ring is fused with five and six membered ring containing one hetero atom; Indole, Quinoline and Isoquinoline.

2. **REACTION MECHANISM:**

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

3. **REACTIVE INTERMEDIATE AND FREE RADICALS:**

Introduction: Generation, stability and Reaction of the following Intermediates; Carbocations, Carbanions, Carbenes, Nitrenes, Benzynes.

Type of reactions: An Overview.

Free radicals: Free radical scavengers and their applications.

4. **CARBONIUM ION RE-ARRANGEMENTS:** Pinacol-Pinacolone, Wagner-Meerwein, Wolff, Hofmann and Beckmann rearrangements.

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

PHARMACEUTICAL CHEMISTRY-IB (ORGANIC) [PRACTICAL]
PHARM 323

Marks:50

Cr.Hr.01

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

Recommended Books:

PHARMACEUTICAL CHEMISTRY (ORGANIC)

1. Bansel RK. **Organic Reaction Mechanism.** 3rd Ed. Tata McGraw Hill; 1992.
2. Bhal BS. **Textbook of Organic Chemistry.** 16th Ed. S. Chand & Co; 2007.
3. Block JH, Beale JM. **Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry.** 20th Ed. Lippincott Williams & Wilkins; 2010.
4. Eliel EL, Wilen SH. **Stereochemistry of Carbon Compounds.** 1st Ed. Tata McGraw Hill; 1994.

5. FinarIL. **Organic Chemistry**. 6thEd. Person Education Asia; 2001.
6. Roberts JD, Caserio MC. **Basic Principles of organic Chemistry**. 3rd Ed. Addison Wesley; 1990.
7. Sykes P. **Guide Book to Mechanism in Organic Chemistry**. 6th Ed. Longman Co; 1991. Vogel AI, TatchellAR, Furnis BS, Hannaford AJ, Smith PWG. **Vogel's Textbook of Practical Organic Chemistry**. 5th Ed. Pearson Education Limited; 1996.
8. Wade LG. **Organic Chemistry**. 7th Ed. Prentice Hall; 2010.

PHARMACEUTICAL CHEMISTRY-IIB (BIOCHEMISTRY) [THEORY]	Marks: 100	Cr. Hr. 03
PHARM 324		

1. METABOLIC FATE OF BIOMOLECULES (Anabolism and Catabolism):

- a. Carbohydrates: Brief introduction to the digestion and absorption of carbohydrates, Aerobic and anaerobic breakdown of Glucose, Glycolysis, Pentose Phosphate Pathway, Glycogenolysis, Glycogenesis, Gluconeogenesis, Citric acid cycle, Energetics of various metabolic processes.
- b. Lipids: Brief introduction to the digestion and absorption of lipids, Oxidation of fatty acids through β -oxidation, Biosynthesis of fatty acids, neutral lipids and cholesterol.
- c. Proteins and Amino acids: Brief introduction to the digestion and absorption of proteins and amino acids, Metabolism of essential and non-essential amino acids, Biosynthesis and catabolism of Haemins and porphyrin compounds.
- d. Bioenergetics: Principles of bioenergetics, Electron transport chain and oxidative phosphorylation.

2. REGULATION OF METABOLIC PROCESSES:

- a. Role of Vitamins: Physiological role of Fat-soluble (A, D, E and K) and Water-soluble (Thiamin, Riboflavin, Pantothenic acid, Niacin, Pyridoxal phosphate, Biotin, Folic acid, Cyanocobalamin-members of B-complex family and Ascorbic acid), Coenzymes and their role in the regulation of metabolic processes.
- b. Receptor Mediated regulation (Hormones): Mechanism of action of hormones, Physiological roles of various hormones, Site of synthesis and target sites of hormones.
- c. Secondary Messengers: Role of cAMP, Calcium ions and phosphoinositol in the regulation of metabolic processes.
- d. Gene Expression: Replication, Transcription and Translation (Gene expression) Introduction to Biotechnology and Genetic Engineering, Basic principles of Recombinant DNA technology, Pharmaceutical applications, Balance of Catabolic, Anabolic and Amphibolic processes in human metabolism, Acid-Base and Electrolyte Balance in Human body.

3. INTRODUCTION TO CLINICAL CHEMISTRY:

Introduction and importance of the clinical chemistry. Laboratory tests in diagnosis of diseases including Uric acid, Cholesterol, Billirubin and Creatinine.

PHARMACEUTICAL CHEMISTRY-IIB (BIOCHEMISTRY) [PRACTICAL] PHARM

325

Marks: 50

Cr. Hr. 01

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

Recommended Books:**PHARMACEUTICAL CHEMISTRY (BIOCHEMISTRY)**

1. Berg JM, Tymoczko JL, Stryer L. **Biochemistry**. 7th Ed. WH Freeman and Company; 2010.
2. Bishop ML, Fody EP, Schoeff LE. **Clinical Chemistry: Techniques, Principles and Correlations**. 6th Ed. Lippincott Williams & Wilkins; 2009.
3. Champe PC, Harvey RA. **Illustrated Biochemistry**. 4th Ed. Lippincot Company; 2007.
4. ChaterjeeMN. **Medical Biochemistry**. 7th Ed. Jaypee Brothers Medical Publishers; 2007.
5. Conn EE, Stumpf PK. **Outlines of Biochemistry**. 5th Ed. John Willey & Sons; 1999.
6. Lehninger AL. **Principles of Biochemistry**. 4th Ed. CBS Publisher; 2004.
7. Murray R, Rodwell V, Bender D, Kathleen M, Botham P, Weil A et al. **Harper's Illustrated Biochemistry**. 28th Ed. Print-Hall; 2009.
8. West ES, Todd RW, Van BTJ. **Text Book of Biochemistry**. The MacMillan Co; 1996.

PHYSIOLOGY-B
PHARM 326

Marks: 100

[THEORY]
Cr. Hr. 03**Coordinated Body Functions:**

- a. **Circulation:** Plasma, the Blood Cell, Pressure, flow and resistance, Anatomy, Heartbeat coordination, Mechanical Events of the Cardiac Cycle, The Cardiac output, Measurement of Cardiac Function, Arteries, Arterioles, Capillaries, veins, The Lymphatic system, Baroreceptor Reflexes, Blood Volume and Long term Regulation of Arterial Pressure, Other Cardiovascular Reflexes and Responses, Hemorrhage and Other Causes of Hypotension, the Upright Posture, Exercise, Hypertension, Heart Failure, Coronary Artery Disease and Heart Attacks, Formation of Platelet Plug, Blood coagulation: Clot Formation, Anticlotting systems, Anticlotting Drugs.
- b. **Respiration:** Organization of the Respiratory System, Ventilation and Lung Mechanics, Exchange of Gases in Alveoli and tissues, Transport of Oxygen in Blood, Transport of Carbon dioxide in Blood, Transport of Hydrogen ions between Tissues and Lungs, Control of Respiration, Hypoxia, Nonrespiratory functions of the Lungs.

- c. The kidneys and Regulation of Water and Inorganic Ions: Renal Functions, Structure of the Kidneys and Urinary System, Basic Renal Process, The Concept of Renal Clearance Micturition, Total Body Balance of sodium and Water Basic Renal Process for sodium and Water, Renal Sodium Regulation, Renal Water regulation, A Summary Example: the response to Sweating, Thirst and Salt Appetite, Potassium Regulation, Effector Sites for Calcium Homeostasis, Hormonal controls, Metabolic Bone Disease, Source of Hydrogen Ion gain or loss, Buffering of Hydrogen Ions in the Body, Integration of Homeostatic Controls, Renal Mechanisms, Classification of Acidosis and Alkalosis, Diuretics, Kidney Disease.
- d. The Digestion and Absorption of Food (Overview): Functions of the Gastrointestinal Organs, Structure of the Gastrointestinal Tract Wall, Digestion and Absorption, Regulation of Gastrointestinal Processes, Pathophysiology of the Gastrointestinal Tract.
- e. Regulation of Organic Metabolism, Growth and Energy Balance: Events of the Absorptive and Postabsorptive States, Endocrine and Neural Control of the Absorptive and Postabsorptive States, Fuel Homeostasis in Exercise and Stress Diabetes Mellitus, Hypoglycemia as a Cause of Symptoms, Regulation of Plasma Cholesterol, Bone Growth, Environmental Factors, Influencing Growth, Hormonal Influences on Growth, compensatory Growth, Basic Concepts of Energy Expenditure, Regulation of Total Body Energy Stores, Regulation of Body Temperature.
- f. Reproduction: General Principles of Gametogenesis, Anatomy, Spermatogenesis, Transport of Sperm, Hormonal control of Male Reproductive Functions, Ovarian Function, Control of Ovarian Function, Uterine Changes in the Menstrual Cycle, Other Effects of Estrogen and Progesterone, Androgens in Women, Female Sexual Response, Pregnancy, Sex Determination, Sex Differentiation, Puberty, Menopause.
- g. Defense Mechanisms of the Body: Cells Mediating Immune Defenses, Nonspecific Immune Defenses, Specific Immune Defenses, Systemic Manifestations of Infection Factors that Alter the Body's Resistance to Infection, Harmful Immune Responses, Absorption, Storage Sites, Excretion, Biotransformation, Functions of Cortisol in Stress, Functions of the Sympathetic Nervous System in Stress, Other Hormones Released During Stress Psychological Stress and Disease.

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

PHYSIOLOGY-B
PHARM 327

Marks: 50

[PRACTICAL]
Cr. Hr. 01

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

1. BLOOD: Determination of Haemoglobin (Hb), Determination of ESR, RBC Count, WBC Count, DLC (Differential Leucocyte Count), Bleeding Time, Coagulation Time and Blood groups.
2. RESPIRATION: Estimation of vital capacity and its relation to posture and standard vital capacity, Determination of Tidal volume and Demonstration of Artificial Respiration.
3. CARDIOVASCULAR SYSTEM: Recording of Arterial Pulse, Recording of Arterial Blood Pressure and Electro-cardiogram.

Recommended Books:

PHYSIOLOGY

1. Chatterjee CC. **Human Physiology**. 9th Ed. Medical Allied Agency; 1994.
2. Cyril A, Neil E, Joels N. **Samson Wright's Applied Physiology**. 13thEd.OxfordUniversity Press; 1992.
3. Guyton AC. **Text Books of Medical Physiology**. 9th Ed. W B Saunders Company; 2011.
4. Kuntzman AJ, Tortora GJ. **Anatomy and physiology for the manual therapies**. 1st Ed. John Wiley & Sons; 2009.
5. Martini F. **Fundamentals of anatomy and physiology**. 8th Ed. Prentice Hall; 2010.
6. SaladinKS, Miller L. **Anatomy & physiology: The Unity of Form and Function**. 6th Ed. McGraw-Hill; 1998.
7. Snell RS. **Clinical Anatomy for Medical Students**. 1st Ed. Litle Brown & CoInc; 1992.
8. Spence AP, Elliot B, Mason EB. **Human Anatomy and Physiology**. 3rd Ed. West Publishing Company; 1992.
9. Stuart Ira. **Human Physiology**. 11th Ed. Fox; 2008.
10. Tortora GJ, Derrickson B. **Principles of anatomy and physiology**. 13th Ed. Wiley; 2010.
11. Widmaier E, Raff H, Strang K. **Vander's Human Physiology**. 12th Ed. McGraw Hill; 2010.
12. William F, Ganong WF. **Review of Medical physiology**. 22nd Ed. Prentice Hall International Inc; 2005.

SECOND PROFESSIONAL

FIRST SEMESTER

ISLAMIC STUDIES

IS 402

Marks : 100

Cr. Hr. 03

Course Objectives: This course is aimed at;

1. To provide Basic information about Islamic Studies
2. To enhance understanding of the students regarding Islamic Civilization 3. To improve Students skill to perform prayers and other worships
4. To enhance the skill of the students for understanding of issues Related to faith and religious life.

1. INTRODUCTION TO QURANIC STUDIES:

1. Basic Concepts of Quran
2. History of Quran
3. Uloom-ul -Quran

2. STUDY OF SELECTED TEXT OF HOLLY QURAN:

1. Verses of Surah Al-Baqra Related to Faith (Verse No. 284-286).
2. Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No. 1-18).
3. Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No. 1-11).
4. Verses of Surah al-Furqan Related to Social Ethics (Verse No. 63-77).
5. Verses of Surah Al-Inam Related to Ihkam (Verse No. 152-154).

3. STUDY OF SELECTED TEXT OF HOLLY QURAN:

1. Verses of Surah Al-Ihzab Related to Adab-al-Nabi (Verse No. 6, 21, 40, 56, 57, 58).
2. Verses of Surah Al-Hashar (18, 19, 20) Related to thinking, Day of Judgment.
3. Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No. 1, 14).

4. SEERAT OF HOLY PROPHET (S.A.W) I:

1. Life of Muhammad Bin Abdullah (Before Prophet Hood)
2. Life of Holy Prophet (S.A.W.) in Makkah
3. Important Lessons Derived from the life of Holy Prophet (S.A.W.) in Makkah

5. SEERAT OF HOLY PROPHET (S.A.W) II:

1. Life of Holy Prophet (S.A.W.) in Madina
2. Important Events of Life Holy Prophet (S.A.W.) in Madina
3. Important Lessons Derived from the life of Holy Prophet (S.A.W.) in Madina

6. INTRODUCTION TO SUNNAH:

1. Basic Concepts of Hadith
2. History of Hadith

3. Kinds of Hadith
4. Uloom –ul-Hadith 5. Sunnah & Hadith
6. Legal Position of Sunnah

7. **SELECTED STUDY FROM TEXT OF HADITH:**

8. **INTRODUCTION TO ISLAMIC LAW & JURISPRUDENCE:**

1. Basic Concepts of Islamic Law & Jurisprudence
2. History & Importance of Islamic Law & Jurisprudence 3. Sources of Islamic Law & Jurisprudence
4. Nature of Differences in Islamic Law
5. Islam and Sectarianism

9. **ISLAMIC CULTURE & CIVILIZATION:**

1. Basic Concepts of Islamic Culture & Civilization
2. Historical Development of Islamic Culture & Civilization
3. Characteristics of Islamic Culture & Civilization
4. Islamic Culture & Civilization and Contemporary Issues

10. **ISLAM & SCIENCE:**

1. Basic Concepts of Islam & Science
2. Contributions of Muslims in the Development of Science 3. Quranic & Science

11. **ISLAMIC ECONOMIC SYSTEM:**

1. Basic Concepts of Islamic Economic System
2. Means of Distribution of wealth in Islamic Economics 3. Islamic Concept of Riba
4. Islamic Ways of Trade & Commerce

12. **POLITICAL SYSTEM OF ISLAM:**

1. Basic Concepts of Islamic Political System 2. Islamic Concept of Sovereignty
3. Basic Institutions of Govt. in Islam

13. **ISLAMIC HISTORY:**

1. Period of Khlaft-E-Rashida
2. Period of Ummayyads
3. Period of Abbasids

14. **SOCIAL SYSTEM OF ISLAM:**

1. Basic Concepts of Social System of Islam 2. Elements of Family
3. Ethical Values of Islam

Recommended Books:

ISLAMIC STUDIES

1. Bhatia HS. **Studies in Islamic Law: Religion and Society.** Deep & Deep Publications New Delhi; 1989.

2. Hasan A. **Principles of Islamic Jurisprudence.** Islamic Research Institute, International Islamic University, Islamabad; 1993.
3. Hassan HH. **An Introduction to the Study of Islamic Law.** Leaf Publication Islamabad, Pakistan.
4. Muhammad HU. **Emergence of Islam.** IRI, Islamabad.
5. Muhammad HU. **Introduction to Islam.** Maulana Muhammad Yousaf Islahi. 6. Muhammad HU. **Muslim Conduct of State.**
7. Waliullah M. **Muslim Jrisprudence and the Quranic Law of Crimes.** Islamic Book Service; 1982.
8. Zia-ul-Haq M. **Introduction to Al-Sharia Al-Islamia.** AllamaIqbal Open University, Islamabad; 2001.

PHARMACEUTICS-IIA (Dosage Form Science)

[THEORY]

PHARM 410

Marks : 100

Cr. Hr. 03

1. **PHARMACEUTICAL CALCULATIONS:** Some Fundamentals of Measurements and Calculations. The Metric System. The Common Systems. Conversions. Calculation of Doses. Percentage calculations, Reducing and Enlarging Formulas. Weights and Volumes of Liquids. HLB Values. Industrial Calculations. Calculations involving parenteral admixtures. Some calculations involving Hydrogen-ion concentration. Calculations involving isotonic, electrolyte and buffer solutions.
2. **INTRODUCTION:** Dosage form, Ingredient, Product formulation.
3. **GALENICAL PREPARATIONS:** Infusions, Decoctions, Extracts, Fluid extracts, Tinctures, Aromatic waters.
4. **SOLVENTS USED IN PHARMACEUTICAL PREPARATIONS:**
5. **ORAL SOLUTIONS, SYRUPS, ELIXIRS AND SPIRITS:** Solutions: their preparation, dry mixtures for solution, oral rehydrate solutions, oral colonic lavage solution. Syrup: components and preparation of syrups. Elixirs: Preparation of elixirs, Medicated and non-Medicated elixirs. Spirits: Preparation of Spirits.
6. **ORAL SUSPENSIONS, EMULSIONS, MAGMA AND GELS:** Preparations, examples and importance.
7. **TOPICAL AND TRANSDERMAL DRUG DELIVERY SYSTEMS:** Introduction of Ointments, Creams, Pastes, Poultice, Plasters, Lotions, Liniments, Topical gels, Topical Tinctures, Collodions, Topical solutions, Topical powders, Percutaneous absorption, Transdermal systems in use.
8. **OPHTHALMIC, NASAL AND OTIC PREPARATIONS:** Ophthalmic solutions, suspensions, ointment, inserts, contact lens solutions. Nasal decongestant solutions, Decongestant inhalers. Ear preparations: Anti-infective, anti-inflammatory and analgesic.

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. Preparation of simple syrup, Orange syrup, Ferrous sulphate syrup, Cod Liver oil Emulsion, Liquid paraffin Emulsion, Throat paint (Mandle's paint), Boroglycerine glycerite, Tannic acid glycerin, Spirit ammonia aromatic, Spirit of Ethyl Nitrite. Preparation of Methyl salicylate ointment, Sulphur ointment, Calamine lotion, Iodine tincture, Preparations of oral hygiene products, Poultice of Kaolin, Effervescent granules, Distilled Water for Injections (A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACEUTICS (DOSAGE FORM SCIENCE)

1. Allen LV, Popovich NG, Ansel HC. **Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems**. 9th Ed. Lippincott Williams & Wilkins; 2010.
2. Armstrong NA, James KC. **Understanding Experimental Design and Interpretation in Pharmaceutics**. 1st Ed. Taylor & Francis Ltd; 1990.
3. Aulton ME. **Aulton's Pharmaceutics: The Design and Manufacture of Medicines**. 3rd Ed. Churchill Livingstone; 2007.
4. Bentley AO. **Text book of Pharmaceutics**. 8th Ed. Macmillan Publishing Co Inc; 1977.
5. Carstensen JT. **Pharmaceutics of Solids and Solid Dosage Forms**. 1st Ed. John Wiley & Sons Inc; 1977.
6. Davis H. **Bentley's Text book of Pharmaceutics**. 2nd Ed. Tindall and Cox Publishers; 1961.
7. Dittert LW. **Sprowl's American Pharmacy**. 7th Ed. JB Lippincott Co; 1990.
8. Finlay WH. **The Mechanics of Inhaled Pharmaceutical Aerosols: An Introduction**. 1st Ed. Academic Press; 2001.
9. Florence AT, Siepmann J. **Moderen Pharmaceutics: Basic Principles and Systems**. 5th Ed. Taylor & Francis; 2009.
10. Ghosh T, Jasti B. **Theory and Practice of Contemporary Pharmaceutics**. 1st Ed. CRC Press; 2005.
11. Kleemann A, Engel J, Kutscher B, Reichert D. **Pharmaceutical Substances: Synthesis, Patents, Applications of the most relevant APIs**. 5th Ed. Thieme; 2008.
12. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design**. 1st Ed. Informa HealthCare; 1998.
13. Lund W. **The Pharmaceutical Codex: Principles and Practice of Pharmaceutics**. 12th Ed. The Pharmaceutical Press; 1994.
14. Mehta D. **British National Formulary (BNF)**. 54th Ed. Pharmaceutical Press; 2007.
15. Rowe RC. **Handbook of Pharmaceutical Excipients**. 6th Ed. Pharmaceutical Press; 2009.
16. Sinko PJ, Martin AN. **Martin's physical pharmacy and pharmaceutical sciences: physical chemical and biopharmaceutical principles in the pharmaceutical sciences**. 5th Ed. Lippincott Williams & Wilkins; 2006.
17. Winfield AJ, Richards RME. **Pharmaceutical practice**. 3rd Ed. Elsevier Health Sciences; 2004.
18. Zinc G. **Remington: The Science and Practice of Pharmacy**. 21st Ed. Philadelphia College of Pharmacy and Science; 2005.

PHARMACEUTICS-III A (Pharm. Microbiology & Immunology) [THEORY]
PHARM 412 **Marks: 100** **Cr. Hr. 03**

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

1. **GENERAL MICROBIOLOGY:** Historical Introduction, Scope of Microbiology with special reference to Pharmaceutical Sciences. Nomenclature and classification of Micro-organisms.
2. **MICRO-ORGANISMS:**
 - a) **The Bacteria:** General and cellular Morphology, structure and function Classification of Bacteria. Growth curve, growth factors and growth characteristics. Nutrition Requirements and Nutrition factors affecting growth. Culture Media, Bacterial cultures and staining methods.
 - b) **The Viruses:** Introduction, Classification (and detail of at least one species from every group), cultivation and replication.
 - c) **The Fungi/Yeast/Molds:**
 - d) **The Protozoa:** Characteristics. Nutrition Requirements and Nutrition factors affecting growth. Culture Media, Bacterial cultures and staining methods.
- b) **The Viruses:** Introduction, Classification (and detail of at least one species from every group), cultivation and replication.
- c) **The Fungi/Yeast/Molds:**
- d) **The Protozoa:**
3. **THE NORMAL FLORA:**
 - (a) Microbiology of air, water and soil (general introduction and normal inhabitants of air, water and soil).
 - (b) Normal flora of Skin, Intestinal tract, Ear, Nose etc.

PHARMACEUTICS-III A (Pharm. Microbiology & Immunology) [PRACTICAL] PHARM
413 **Marks: 50** **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 assays of antibiotics and vitamins. Preparation of general and selective Media and culturing of microorganisms. Total and viable counts of micro-organism. Morphological and selective biochemical characterization of some specimen. Staining of Bacteria: Gram method, Acid fast, Giemasa staining, Capsule staining, Flagella staining and Spore staining. Microbiological analysis of air, water and soil (Note: A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACEUTICS (PHARM. MICROBIOLOGY & IMMUNOLOGY)

1. Brooks G, Carroll KC, Butel J, Morse S, Mietzner T. **Jawetz, Melnick & Adelberg's Medical Microbiology and Immunology**. 24th Ed. Churchill Livingstone; 2010.
2. Collins CH, Lynes PM, Grange JM, Falkinham JO. Collins & Lyne's **Microbiological Methods**. 8th Ed. Vutterworth Heineman; 2004.
3. Fraise A, Lambert PA, Maillard JY. **Russell, Hugo & Ayliffe's Principles and Practice of Disinfection, Preservation & Sterilization**. 4th Ed. Wiley Blackwell; 2004.
4. Harvey RA, Champe PC, Fisher BD. **Microbiology: Lippincott's Illustrated Reviews Series**. 4th Ed. William & Willkins; 2004.
5. Hugo WB, Russell AD. **Pharmaceutical Microbiology**. 7th Ed. Black Well Science Ltd; 1998.
6. Hugo WB, Denyer SP, Hodges NA, Gorman SP. **Hugo and Russell's pharmaceutical microbiology**. 7th Ed. Wiley Blackwell; 2004.
7. McKane L, Kandel J. **Microbiology: Essentials and Application**. 2nd Ed. McGraw Hill Inc; 1995.
8. Pelczar MJ. **Microbiology**. 7th Ed. McGraw Hill Inc; 2007.
9. Pommerville JC. **Alcamo's Funtamentals of Microbiology**. 9th Ed. John Bartlett Publishers; 2010.
10. Singleton P, Sainsbury D. **Dictionary of Microbiology and Molecular Biology**. 3rd Ed. John Willey & Sons; 2006.
11. Willey J, Sherwood L, Woolverton C. **Prescott's Microbiology**. 8th Ed. C Brown Publishers; 2010.

PHARMACOLOGY & THERAPEUTICS-IA
PHARM 414

Marks: 100

[THEORY]
Cr.Hr.03

1. GENERAL PHARMACOLOGY:

- a) Pharmacology: Definition of Pharmacology, history and its various branches. Definition of Drug and its various sources.
- b) Routes of drug administration, advantages and disadvantages.
- c) Pharmacokinetics: Drug solubility and passage of drug across the biological membranes. Absorption, distribution, metabolism and elimination of drugs and factors affecting them. Various pharmacokinetic parameters including volume of distribution (Vd), clearance (Cl), Biological half life ($t_{1/2\beta}$) Bioavailability and various factors affecting it. Dose, Efficacy and Potency of drugs. Hypersensitivity and Idiosyncratic reactions, drug tolerance and dependence. Drug interactions. Plasma protein binding.
- d) Pharmacodynamics: How drugs act? Receptors and their various types with special reference to their molecular structures. Cell surface receptors, signal transduction by cell surface receptors, signaling Mediated by intra cellular receptors, target cell and hyper sensitization, Pharmacological effects not Mediated by receptors (for example anesthetics and cathartics) Ion channel, enzymes, carrier proteins, Drug receptor interactions and theories of drug action. Agonist, antagonist, partial agonist,

inverse agonist. Receptors internalization and receptors co-localization. Physiological Antagonism, Pharmacological Antagonism (competitive and non-competitive), Neutralization Antagonism, Neurotransmission and neuro-modulation. Specificity of drug action and factors modifying the action & dosage of drugs. Median lethal dose (LD:50), Median effective dose (ED:50) and Therapeutic Index, Dose-response relationships.

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

- a. Organization of ANS its subdivisions and innervations.
- b. Neurotransmitters in ANS, their synthesis, release and fate.
- c. Sympathetic agonists: Catecholamines and Noncatecholamines.
- d. Sympathetic antagonists: Adrenergic receptor Blockers and neuron blockers.
- e. Parasympathetic (Cholinergic) agonists and cholinesterase enzyme inhibitors (anticholinesterases) Parasympathetic antagonists.
- f. Ganglion stimulants and Ganglion blockers
- g. Neuromuscular Blockers

3. **DRUGS ACTING ON GASTROINTESTINAL TRACT:**

- a. Emetic and anti-emetics
- b. Purgatives
- c. Anti-diarrheal agents
- d. Treatment of Peptic & duodenal ulcer: Antacids, H₂-Receptor antagonists, antimuscarinic agents, proton pump inhibitors, prostaglandin antagonists, gastrin receptor antagonist and cytoprotective agents
- e. Drug treatment of chronic inflammatory bowel diseases
- f. Drugs affecting bile flow and Cholelithiasis

NOTE:

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

PHARMACOLOGY & THERAPEUTICS-IA
PHARM 415

Marks: 50

[PRACTICAL]
Cr. Hr. 01

NOTE: Practical of the subject shall be designed from time to time on the basis of the theoretical topics and availability of the facilities e.g. Preparation of standard solution. Ringer solution. Tyrode solution. Krebs solution. Normal saline solution. To demonstrate the effects of sympathomimetic (Adrenaline) & sympatholytic drugs (Propranolol) on Frog's heart. To demonstrate the effects of parasympathomimetic (Acetylcholine) and parasympatholytic (Atropine) drugs on Frog's heart. To demonstrate the effects of an unknown drug on Frog's heart. Routes of Administration of drugs. To demonstrate

the effects of vasoconstrictor drugs on Frog's blood vessels. To demonstrate the effects of stimulant drugs on Rabbit's intestine (Acetyl choline, Barium chloride). To demonstrate the effects of depressant drugs on Rabbit's intestine (Atropine). To differentiate the effects of an unknown drug on Rabbit's intestine and identify the (unknown) drug. To study the effects of Adrenaline on Rabbit's Eyes. To study the effects of Homatropine on Rabbit's Eyes. To study the effects of Pilocarpine on Rabbit's Eyes. To study the effects of Local Anaesthetic drug (e.g Cocaine) on Rabbit's Eyes. To identify the unknown drug & differentiate its effects on Rabbit's Eyes. To demonstrate emetic effects of various drugs in pigeons (Note: A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACOLOGY & THERAPEUTICS

1. Brunton L, Lazo J, Parker K. **Goodman & Gilman's Pharmacological Basis of Therapeutics.** 11th Ed. McGraw Hill Book Company; 2005.
2. Chang HM, But PPH, Yao SC, Wang LL, Yeung SCS. **Pharmacology and applications of Chinese Materia Medica.** 3rd Ed. World Scientific Pub Co Inc; 2000.
3. Ebadi M. **Pharmacology.** 3rd Ed. Little Brown & Company; 1996.
4. Harvey RA, Champe PC. **Lippincott's Illustrated Reviews: Pharmacology.** 4th Ed. Lippincott William & Wilkins; 2008.
5. Humphrey P. **Rang & Dale's Pharmacology.** 6th Ed. Churchill Livingstone; 2007.
6. Katzung BG, Masters SB, Trevor AJ. **Basic & Clinical Pharmacology.** 11th Ed. McGraw Hill; 2009.
7. Koda KMA, Young LY, Kradjan WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs.** 9th Ed. Lippincott Williams & Wilkins; 2008.
8. Laurence DR. **Clinical Pharmacology.** 8th Ed. ELBS Publishers; 1998.
9. Ritter JM, Levis LD. **A Text Book of Clinical Pharmacology.** 5th Ed. Oxford University Press; 2008.
10. Satorkar RS, Bhandarkar SD. **Pharmacology and Pharmacotherapeutics.** 19th Ed. Bomby: Popular Prakashan; 1998.
11. Tripathi JD. **Essentials of Medical Pharmacology.** 6th Ed. Jaypee Brothers; 2008.
12. Wecker L, Crespo L, Dunaway G, Faingold C, Watts S. **Brody's Human Pharmacology.** 5th Ed. Mosby Inc; 2009.

PHARMACOGNOSY-IA (Basic)
PHARM 416

Marks: 100

[THEORY]
Cr.Hr.03

1. **GENERAL INTRODUCTION:** Historical development and scope of Pharmacognosy. Terminology used in Pharmacognosy. An introduction of traditional systems (Unani, Ayurvedic and Homoeopathic systems of medicine) with special reference to medicinal plants. Introduction to herbal pharmacopoeia and modern concepts about Pharmacognosy.
2. **Crude Drugs:** Preparation of crude drugs for commercial market. Chemical and Therapeutic classification of crude drugs (Official & Un-official drugs). Methods of Cultivation, Drying, Storage, Preservation and Packing.

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

S. No.	Families	Crude Drugs
a.	Ranunculaceae	<i>Aconitum, Larkspur, Pulsatilla, Hydrastis</i>
b.	Papaveraceae	<i>Papaver somniferum, Sanguinaria, Canadensis</i>
c.	Leguminosae	<i>Acacia, Glycyrrhiza, Senna, Cassia, Tamarind</i>
d.	Umbelliferae	<i>Fennel, Carum, Coriander, Conium, Asafoetida</i>
e.	Apocynaceae	<i>Rauwolfia, Catharanthus</i>
f.	Asclepiadaceae	<i>Gymnema sylvestre, Calotropis gigantea</i>
g.	Compositae	<i>Artemisia, Silybum marianum, Echinaceae, Arctium lappa</i>
h.	Solanaceae	<i>Belladonna, Hyoscyamus, Stramonium, Capsicum</i>
i.	Scrophulariaceae	<i>Digitalis, Verbascum (Mullien).</i>
j.	Labiatae	<i>Peppermint, Thyme, Spearmint, Salvia, Ocimum</i>
k.	Liliaceae	<i>Garlic, Colchicum, Aloe</i>
l.	Zingiberaceae	<i>Ginger, Curcuma</i>

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

PHARMACOGNOSY-IA

PHARM 417

Marks: 50

[PRACTICAL]

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. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters). Microscopic examination of powders and sections of plant drugs.

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

A Study Tour will be an integral part of the syllabus and will be arranged at the end of the session for collection of medicinal plants from the country.

Recommended Books:

PHARMACOGNOSY

1. Anonymous. **Monographs of Unani Medicine.** Hamdard Foundation Pakistan; 2003.
2. Baker BM, Bender DA. **Vitamins in Medicine.** 12th Ed. Academic Press; 1982.
3. Brain KR, Turner TD. **The Practical Evaluation of Phytopharmaceuticals.** 1st Ed. Scientehnica Publishers; 1975.
4. Braun L, Cohen M. **Herbs and Natural Supplements: An Evidence Based Guide.** 3rd Ed. London: Elsevier Mosby; 2010.
5. Chauhan P. **Ayurvedic Pharmacognosy.** 1st Ed. Sonali Publications; 2007.

6. Cutler SJ, Cutler HG. **Biologically Active Natural Products: Pharmaceuticals.** 1st Ed. CRC Press Publisher; 1999.
7. Dewick PM. **Medicinal Natural Products: A Biosynthetic Approach.** 1st Ed. John Wiley & Sons; 1997.
8. Evans WC, Trease GE, Evans D. **Trease and Evan's Pharmacognosy.** 16th Ed. Elsevier Health Sciences Publisher; 2009.
9. Forhne D, Pfander HJ. **Poisonous Plants: A Hand Book for Doctors, Pharmacists, Toxicologists, Biologists and Veterinarians.** 2nd Ed. Timber Press; 2005.
10. Harborne JB, Baxter H. **The Hand Book of Natural Flavonoids.** 2nd Ed. John Willey & Son; 1999.
11. Jackson BP. **Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices.** 2nd Ed. CBS Publishers; 2005.
12. Khandelwal K. **Practical Pharmacognosy.** 8th Ed. Nirali Prakashan Publishers; 2008.
13. Lesley Braun and Marc Cohen. **Herbs and Natural Supplements: An evidence Based guide.** 3rd Ed. London: Elsevier Mosby; 2010.
14. Lockwood B. **Nutraceuticals: A Guide for Healthcare Professionals.** 2nd Ed. Pharmaceutical Press; 2007.
15. Mannito P. **Biosynthesis of Natural Products.** John Wiley & Sons; 1981.
16. Manske RHF. **Alkaloids: Chemistry and Physiology.** Academic Press; 1970.
17. Partab Chauhan. **Ayurvedic Pharmacognosy.** 1st Ed. Sonali Publications; 2007. 18. Ross IA. **Medicinal Plants of the World.** 2nd Ed. Humana Press; 2003.
19. Smith AB. **Poisonous Plants of All Countries.** 2nd Ed. Periodical Expert Book; 1988.
20. Smith AB. **Poisonous Plants of all Countries: With the Active, Chemical Principles Which They Contain; and the Toxic Symptoms Produced by Each Group.** 4th Ed. General Books LLC; 2010.
21. Tyler VE, Brady LR, Robbers JE. **Pharmacognosy.** 10th Ed. Lea and Febiger; 2001.
22. Wichtl M. **Herbal Drugs and Phytopharmaceuticals.** 3rd Ed. Medpharm Publishers; 2004.

PHARMACY PRACTICE-1A (PHARMACEUTICAL MATHEMATICS) PHARM 418	Marks: 100	Cr. Hr. 03
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1. **ALGEBRA:**
 - (a) Solution of Linear and Quadratic Equations. Equations reducible to Quadratic Form. Solution of simultaneous Equations.
 - (b) Arithmetic, Geometric and Harmonic Progressions: Arithmetic, Geometric and Harmonic Means.
 - (c) Permutations and Combinations:
 - (d) Binomial Theorem: Simple application.
2. **TRIGONOMETRY:** Measurement of angles in Radian and Degrees. Definitions of circular functions. Derivation of circular function for simple cases.
3. **ANALYTICAL GEOMETRY:** Coordinates of point in a plane. Distance between two points in a plane. Locus, Equations of straight line, Equation of Parabola, Circle and Ellipse.

4. **DIFFERENTIAL CALCULUS:** Functions, variations in functions, limits, differential coefficient, differentiation of algebraic, trigonometric, exponential and logarithmic functions, partial derivatives. Maxima and minima values. Points of inflexion.
5. **INTEGRAL CALCULUS:** Concept of integration Rules of integration. Integration of algebraic, exponential, logarithmic and trigonometric functions by using different techniques, and numerical integration.

Recommended Books:

PHARMACY PRACTICE (PHARMACEUTICAL MATHEMATICS)

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

SECOND SEMESTER

PAKISTAN STUDIES

PS 403

Marks: 0

Cr. Hr. 02

Introduction/Objectives:

- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
 - Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.
1. **HISTORICAL PERSPECTIVE:**
 - a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Dr. Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
 - b. Factors leading to Muslim separatism c. People and Land
 - i. Indus Civilization ii. Muslim advent
 - iii. Location and geo-physical features
 2. **GOVERNMENT AND POLITICS IN PAKISTAN:** Political and constitutional phases:
 - a. 1947-58 b. 1958-71 c. 1971-77 d. 1977-88 e. 1988-99
 - f. 1999-onward
 3. **CONTEMPORARY PAKISTAN:**
 - a. Economic institutions and issues b. Society and social structure
 - c. Ethnicity
 - d. Foreign policy of Pakistan and challenges e. Futuristic outlook of Pakistan

Recommended Books:

PAKISTAN STUDIES

1. Ansar Z. **History & Culture of Sindh**. Royal Book Company; 1980.
2. Aziz KK. **Party Politics in Pakistan**. Sang-e-Meel Publications; 2007. 3. BinSK. **The Political System of Pakistan**. Houghton Mifflin; 1967.
4. Burke SM, Ziring L. **Pakistan's Foreign Policy: A Historical Analysis**. OxfordUniversity Press; 1993.
5. Haq NU. **Making of Pakistan: The Military Perspective**. National Commission on Historical and Cultural Research; 1993.
6. Javed BS. **State & Society in Pakistan**. The Macmillan Press Ltd; 1980.
7. Lawrence Z. **Pakistan: Enigma of Political Development**. Dawson Publishing; 1980.
8. Rafique AM. **Political Parties in Pakistan**. 2nd Ed. National Institute of Historical and Cultural Research; 1986.
9. Safdar M. **Pakistan Kayyun Toota**. Idara-e-Saqafat-e-Islamia;
10. Safdar M. **Pakistan Political Roots & Development**. 1stEd.OxfordUniversity Press; 2003.
11. Tahir A. **Ethno National Movement in Pakistan: Domestic and International Factors**. 1st Ed. Institute of Policy Studies; 1988.
12. Waseem M. **Pakistan under Martial Law**. 1st Ed. Vanguard Books Ltd; 1987. 13. Wayne W. **The Emergence of Banglades**. American Enterprise; 1972. 14. Zaidi AS. **Issue in Pakistan's Economy**. 2ndEd.OxfordUniversity Press; 2006.

1. **SUPPOSITORIES AND ENEMAS:** Semi-solid preparations, Suppositories: Bases, preparation, packaging and storage, Solutions/Enemas: preparation, packing & storage.
2. **AEROSOLS, INHALATIONS AND SPRAYS:** Aerosol: Principle, container and valve assembly, propellants, filling, testing, packaging, labelling and storage. Inhalations: Principle, container and valve assembly, propellants, filling, testing, packaging, labelling and storage. Sprays: Principle, container and valve assembly, propellants, filling, testing, packaging, labelling and storage.
3. **POWDERS, CAPSULES, TABLET DOSAGE FORMS:** Preparation of Powders, mixing of powders, uses and packaging of powders, granules, effervescent granulated salts. Hard gelatin capsules: capsule sizes, preparation of filled hard gelatin capsules. Soft gelatin capsules, preparation and its application. Tablets: types, characteristics and methods of preparation.
4. **INTRODUCTION TO PARENTERALS:** Official types of injections, solvents and vehicles for injections, added substances.
5. **A BRIEF INTRODUCTION TO ORAL HYGIENE PRODUCTS:**

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

Recommended Books:**PHARMACEUTICS (DOSAGE FORM SCIENCE)**

1. Allen LV, Popovich NG, Ansel HC. **Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.** 9th Ed. Lippincott Williams & Wilkins; 2010.
2. Armstrong NA, James KC. **Understanding Experimental Design and Interpretation in Pharmaceutics.** 1st Ed. Taylor & Francis Ltd; 1990.
3. Aulton ME. **Aulton's Pharmaceutics: The Design and Manufacture of Medicines.** 3rd Ed. Churchill Livingstone; 2007.
4. Bentley AO. **Text book of Pharmaceutics.** 8th Ed. Macmillan Publishing Co Inc; 1977.
5. Carstensen JT. **Pharmaceutics of Solids and Solid Dosage Forms.** 1st Ed. John Wiley & Sons Inc; 1977.
6. Davis H. **Bentley's Text book of Pharmaceutics.** 2nd Ed. Tindall and Cox Publishers; 1961.
7. Dittert LW. **Sprowl's American Pharmacy.** 7th Ed. JB Lippincott Co; 1990.
8. Finlay WH. **The Mechanics of Inhaled Pharmaceutical Aerosols: An Introduction.** 1st Ed. Academic Press; 2001.
9. Florence AT, Siepmann J. **Moderen Pharmaceutics: Basic Principles and Systems.** 5th Ed. Taylor & Francis; 2009.

10. Ghosh T, Jasti B. **Theory and Practice of Contemporary Pharmaceuticals**. 1st Ed. CRC Press; 2005.
11. Kleemann A, Engel J, Kutscher B, Reichert D. **Pharmaceutical Substances: Synthesis, Patents, Applications of the most relevant APIs**. 5th Ed. Thieme; 2008.
12. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design**. 1st Ed. Informa HealthCare; 1998.
13. Lund W. **The Pharmaceutical Codex: Principles and Practice of Pharmaceutics**. 12th Ed. The Pharmaceutical Press; 1994.
14. Mehta D. **British National Formulary (BNF)**. 54th Ed. Pharmaceutical Press; 2007.
15. Rowe RC. **Handbook of Pharmaceutical Excipients**. 6th Ed. Pharmaceutical Press; 2009.
16. Sinko PJ, Martin AN. **Martin's physical pharmacy and pharmaceutical sciences: physical chemical and biopharmaceutical principles in the pharmaceutical sciences**. 5th Ed. Lippincott Williams & Wilkins; 2006.
17. Winfield AJ, Richards RME. **Pharmaceutical practice**. 3rd Ed. Elsevier Health Sciences; 2004.
18. Zinc G. **Remington: The Science and Practice of Pharmacy**. 21st Ed. Philadelphia College of Pharmacy and Science; 2005.

PHARMACEUTICS-IIIB (Pharm. Microbiology & Immunology)	[THEORY]
PHARM 422	Cr. Hr. 03
Marks: 100	

1. **INDUSTRIAL MICROBIOLOGY:** Introduction to Sterilization/ Disinfection. Fermentation. Pharmaceutical products produced by fermentation process (Penicillins, Cephalosporins, Gentamycin, Erythromycin, Tetracyclines, Rifamycin, Griseofulvin).
2. **IMMUNOLOGY:** Introduction and types of Immunity: Specific and non-specific (Cellular basis of Immune response. Immunity, autoimmunity, tolerance. Antigen. Anti-bodies). Antigen-Antibody reactions and their clinical and diagnostic applications. Hypersensitivity and allergy. Drug allergy mechanism. Vaccination: Introduction and aims. Types of Vaccines. Current vaccine practices.
3. **FACTORY & HOSPITAL HYGIENE including GOOD MANUFACTURING PRACTICES:** Introduction, Control of Microbial contamination during manufacture. Manufacture of Sterile products, A Guide to Current Good Pharmaceutical Manufacturing Practices.
4. **INTRODUCTION TO DISEASES:** Dengue fever, Bird flu, SARS, or other prevailing diseases of bacteria and virus.

PHARMACEUTICS-IIIB (Pharm. Microbiology & Immunology)	[PRACTICAL]
PHARM 423	Cr. Hr.: 01
Marks: 50	

NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Sterilization of Glassware and pharmaceutical products by various methods. Microbiological assays of: Anti-biotics and vitamins. Preparation of general and selective Media and culturing of microorganisms.

Total and viable counts of micro-organism. Morphological and selective biochemical characterization of some specimen. Staining of Bacteria: Gram method, Acid fast, Giemasa staining, Capsule staining, Flagella staining and Spore staining. Microbiological analysis of air, water and soil (Note: A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACEUTICS (PHARM. MICROBIOLOGY & IMMUNOLOGY)

1. Brooks G, Carroll KC, Butel J, Morse S, Mietzner T. **Jawetz, Melnick & Adelberg's Medical Microbiology and Immunology**. 24th Ed. Churchill Livingstone; 2010.
2. Collins CH, Lynes PM, Grange JM, Falkinham JO. Collins & Lyne's **Microbiological Methods**. 8th Ed. Vutterworth Heineman; 2004.
3. Fraise A, Lambert PA, Maillard JY. **Russell, Hugo & Ayliffe's Principles and Practice of Disinfection, Preservation & Sterilization**. 4th Ed. Wiley Blackwell; 2004.
4. Harvey RA, Champe PC, Fisher BD. **Microbiology: Lippincott's Illustrated Reviews Series**. 4th Ed. William & Willkins; 2004.
5. Hugo WB, Russell AD. **Pharmaceutical Microbiology**. 7th Ed. Black Well Science Ltd; 1998.
6. Hugo WB, Denyer SP, Hodges NA, Gorman SP. **Hugo and Russell's pharmaceutical microbiology**. 7th Ed. Wiley Blackwell; 2004.
7. McKane L, Kandel J. **Microbiology: Essentials and Application**. 2nd Ed. McGraw Hill Inc; 1995.
8. Pelczar MJ. **Microbiology**. 7th Ed. McGraw Hill Inc; 2007.
9. Pommerville JC. **Alcama's Funtamentals of Microbiology**. 9th Ed. John Bartlett Publishers; 2010.
10. Singleton P, Sainsbury D. **Dictionary of Microbiology and Molecular Biology**. 3rd Ed. John Willey & Sons; 2006.
11. Willey J, Sherwood L, Woolverton C. **Prescott's Microbiology**. 8th Ed. C Brown Publishers; 2010.

PHARMACOLOGY & THERAPEUTICS-IB
PHARM 424

Marks: 100

[THEORY]
Cr.Hr.03

1. **AUTACOIDS AND THEIR ANTAGONISTS:** Histamine and anti-histamines, serotonin and serotonin antagonist, prostaglandins and their antagonists.
2. **DRUGS ACTING ON RESPIRATORY SYSTEM:**
 - a. Drugs used in cough (Anti-tussives, Expectorants and Mucoytic agents).
 - b. Drugs used in Bronchial Asthma. Bronchodilators: Sympathomimetic, Xanthine derivatives, Leukotriene receptor antagonists and synthesis inhibitors, Muscarinic receptor antagonists, Cromoglycate, Nedocromil, Cortecosteroids & other Anti-inflammatory drugs.

3. **DRUGS ACTING ON CARDIO-VASCULAR SYSTEM:**
 - a. Angina pectoris and its drug treatment b. Congestive heart failure & its treatment. c. Anti-arrhythmic drugs
 - d. Anti-hyperlipidemic.
 - e. Coagulants and Anti-coagulants f. Anti-hypertensive
 - g. Diuretics
4. **DRUGS ACTING ON GENITOURINARY SYSTEM:** Oxytocin, Ergot alkaloids and uterine relaxants.
5. **ANTI-ANAEMIC DRUGS:**
6. **HORMONES, ANTAGONISTS AND OTHER AGENTS AFFECTING ENDOCRINE FUNCTION:** Endocrine function and dysfunctions. Drug used for therapy of Diabetes Mellitus: Insulin and Oral Hypoglycemic agents, Corticosteroids, Thyroid hormone and anti-thyroid drugs.

NOTE:

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

PHARMACOLOGY & THERAPEUTICS-IB

PHARM 425

Marks: 50

[PRACTICAL]

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.

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

12. To study the effects of Pilocarpine on Rabbit's Eyes.
 13. To study the effects of Local Anaesthetic drug (e.g Cocaine) on Rabbit's Eyes.
 14. To identify the unknown drug & differentiate its effects on Rabbit's Eyes
- (Note: A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACOLOGY & THERAPEUTICS

1. Brunton L, Lazo J, Parker K. **Goodman & Gilman's Pharmacological Basis of Therapeutics**. 11th Ed. McGraw Hill Book Company; 2005.
2. Chang HM, But PPH, Yao SC, Wang LL, Yeung SCS. **Pharmacology and applications of Chinese Materia Medica**. 3rd Ed. World Scientific Pub Co Inc; 2000.
3. Ebadi M. **Pharmacology**. 3rd Ed. Little Brown & Company; 1996.
4. Harvey RA, Champe PC. **Lippincott's Illustrated Reviews: Pharmacology**. 4th Ed. Lippincott William & Wilkins; 2008.
5. Humphrey P. **Rang & Dale's Pharmacology**. 6th Ed. Churchill Livingstone; 2007.
6. Katzung BG, Masters SB, Trevor AJ. **Basic & Clinical Pharmacology**. 11th Ed. McGraw Hill; 2009.
7. Koda KMA, Young LY, Kradjan WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs**. 9th Ed. Lippincott Williams & Wilkins; 2008.
8. Laurence DR. **Clinical Pharmacology**. 8th Ed. ELBS Publishers; 1998.
9. Ritter JM, Levis LD. **A Text Book of Clinical Pharmacology**. 5th Ed. Oxford University Press; 2008.
10. Satorkar RS, Bhandarkar SD. **Pharmacology and Pharmacotherapeutics**. 19th Ed. Bomby: Popular Prakashan; 1998.
11. Tripathi JD. **Essentials of Medical Pharmacology**. 6th Ed. Jaypee Brothers; 2008.
12. Wecker L, Crespo L, Dunaway G, Faingold C, Watts S. **Brody's Human Pharmacology**. 5th Ed. Mosby Inc; 2009.

PHARMACOGNOSY-IB (Basic)

PHARM 426

Marks: 100

[THEORY]

Cr. Hr. 03

1. **DRUGS OF ANIMAL ORIGIN:** General introduction and discussion about honey, gelatin, shellac, musk, civet, ambergris, cod liver oil, cantharides and spermaceti.
2. **BIOLOGICS:** Sources, structure, preparation, description and uses of vaccines, toxins, antitoxins, venoms, antivenoms, antiserums.
3. **SURGICAL DRESSINGS:** Classification of fibers as vegetable, animals and synthetic fibers. Evaluation of fibers in surgical dressings, BPC standards for dressings and sutures. Discussion on cotton, wool, cellulose, rayon, catgut and nylon.
4. **PESTICIDES:** Introduction, methods and control of pests with special reference to pyrethrum, tobacco, and other natural pesticides.

5. **GROWTH REGULATORS:** General account with special reference to plant hormones; Auxins, Gibberellins, Abscisic acid and Cytokinins.
6. **POISONOUS PLANTS INCLUDING ALLERGENS AND ALLERGENIC PREPARATIONS:** General introduction, case history, skin test, treatment of allergy, inhalant, ingestant, injectant, contactant, infectant and infestant allergens. Mechanism of allergy.
7. **ENZYMES:** Enzymes obtained from plant source. (Phytoenzymes). Papain, Bromelain and Malt Extract. Enzymes obtained from Animal source. Rennin, pepsin, Pancreatin and Pancrealipase.

PHARMACOGNOSY-IB
PHARM 427

Marks: 50

[PRACTICAL]
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. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters), Microscopic examination of powders and sections of plant drugs.

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

NOTE: A Study Tour will be an integral part of the syllabus and will be arranged at the end of the session for collection of medicinal plants from the country.

Recommended Books:

PHARMACOGNOSY

1. Anonymous. **Monographs of Unani Medicine.** Hamdard Foundation Pakistan; 2003.
2. Baker BM, Bender DA. **Vitamins in Medicine.** 12th Ed. Academic Press; 1982.
3. Brain KR, Turner TD. **The Practical Evaluation of Phytopharmaceuticals.** 1st Ed. Scientehnica Publishers; 1975.
4. Braun L, Cohen M. **Herbs and Natural Supplements: An Evidence Based Guide.** 3rd Ed. London: Elsevier Mosby; 2010.
5. Chauhan P. **Ayurvedic Pharmacognosy.** 1st Ed. Sonali Publications; 2007.
6. Cutler SJ, Cutler HG. **Biologically Active Natural Products: Pharmaceuticals.** 1st Ed. CRC Press Publisher; 1999.
7. Dewick PM. **Medicinal Natural Products: A Biosynthetic Approach.** 1st Ed. John Wiley & Sons; 1997.
8. Evans WC, Trease GE, Evans D. **Trease and Evan's Pharmacognosy.** 16th Ed. Elsevier Health Sciences Publisher; 2009.
9. Forhne D, Pfander HJ. **Poisonous Plants: A Hand Book for Doctors, Pharmacists, Toxicologists, Biologists and Veterinarians.** 2nd Ed. Timber Press; 2005.
10. Harborne JB, Baxter H. **The Hand Book of Natural Flavonoids.** 2nd Ed. John Willey & Son; 1999.
11. Jackson BP. **Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices.** 2nd Ed. CBS Publishers; 2005.
12. Khandelwal K. **Practical Pharmacognosy.** 8th Ed. Nirali Prakashan Publishers; 2008.

13. Lesley Braun and Marc Cohen. **Herbs and Natural Supplements: An evidence Based guide.** 3rd Ed. London: Elsevier Mosby; 2010.
14. Lockwood B. **Nutraceuticals: A Guide for Healthcare Professionals.** 2nd Ed. Pharmaceutical Press; 2007.
15. Mannito P. **Biosynthesis of Natural Products.** John Wiley & Sons; 1981.
16. Manske RHF. **Alkaloids: Chemistry and Physiology.** Academic Press; 1970.
17. Partab Chauhan. **Ayurvedic Pharmacognosy.** 1st Ed. Sonali Publications; 2007.
18. Ross IA. **Medicinal Plants of the World.** 2nd Ed. Humana Press; 2003.
19. Smith AB. **Poisonous Plants of All Countries.** 2nd Ed. Periodical Expert Book; 1988.
20. Smith AB. **Poisonous Plants of all Countries: With the Active, Chemical Principles Which They Contain; and the Toxic Symptoms Produced by Each Group.** 4th Ed. General Books LLC; 2010.
21. Tyler VE, Brady LR, Robbers JE. **Pharmacognosy.** 10th Ed. Lea and Febiger; 2001.
22. Wichtl M. **Herbal Drugs and Phytopharmaceuticals.** 3rd Ed. Medpharm Publishers; 2004.

PHARMACY PRACTICE-IB (BIO-STATISTICS)

PHARM 428

Marks: 100

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. **SUMMARIZING DATA and VARIATION:** The Mean, the Median, the Mode, the Mean Deviation, the Variance and Standard Deviation, Coefficient of Variation.
4. **CURVE FITTING:** Fitting a Straight Line. Fitting of Parabolic or High Degree Curve.
5. **PROBABILITY:** Definitions, Probability Rules, Probability Distributions (Binomial & Normal Distributions).
6. **SIMPLE REGRESSION AND CORRELATION:** Introduction. Simple Linear Regression Model. Correlation co-efficient.
7. **TEST OF HYPOTHESIS AND SIGNIFICANCE:** Statistical Hypothesis. Level of Significance. Test of Significance. Confidence Intervals, Test involving Binomial and Normal Distributions.
8. **STUDENT “t”, “F” and Chi-Square Distributions:** Test of Significance based on “t”, “F” and Chi-Square distributions.
9. **ANALYSIS OF VARIANCE:** One-way Classification, Two-way Classification, Partitioning of Sum of Squares and Degrees of Freedom, Multiple Comparison Tests such as LSD, The analysis of Variance Models.
10. **STATISTICAL PACKAGE:** An understanding of data analysis by using different statistical tests using various statistical software's like SPSS, Minitab, Statistica etc.

Recommended Books:

PHARMACY PRACTICE (BIO-STATISTICS)

1. Daniel WW. **Bio-Statistics: Foundation for Analysis in Health Science.** 9th Ed. Wiley Publishers; 2009.
2. Nilton JS. **Statistical Methods in Biological and health Sciences.** 3rd Ed. McGrew Hill; 1998.
3. Hoel PG, PortSC, Stone CJ. **Introduction to Statistical Theory.** 1st Ed. Brooks Cole; 1972.
4. Samuels M. **Statistics for the life sciences.** 3rd Ed. Dellen Publishers co; 2002. 5. Zar JH. **Biostatistical analysis.** 4th Ed. Francis Hall; 1999.

THIRD PROFESSIONAL

FIRST SEMESTER

PHARMACY PRACTICE-IIA (Dispensing Pharmacy) [THEORY]
PHARM 510 Marks:100 Cr.Hr.03

1. **BASIC PRINCIPLES OF COMPOUNDING AND DISPENSING INCLUDING:** Fundamental operations in Compounding, Containers and closures for Dispensed Products, Prescription-Handling (Parts of Prescription, Filling, Interpretation, Pricing) and Labelling of Dispensed Medication.
2. **EXTEMPORANEOUS DISPENSING OF:** Solutions, Suspensions, Emulsions, Creams, Ointments, Pastes and gels, Suppositories and pessaries, Powders and granules and Oral unit dosage form.
3. **PHARMACEUTICAL INCOMPATIBILITIES:** Types of Incompatibilities, Manifestations, Correction and Prevention with reference to typical examples.

PHARMACY PRACTICE-IIA (Dispensing Pharmacy) [PRACTICAL]
PHARM 511 Marks:50 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. Practical introduction to prescription handling, interpretation, filling and labeling.

Mixtures: Dispensing of simple mixtures containing soluble substances only, mixtures containing diffusible substances, in-diffusible substances and mixtures forming precipitate.

Powders: Dispensing of simple powders, compound powders and effervescent powders for external use.

Incompatibility: Practical importance of Incompatibilities.

Ointments and Creams: Dispensing of iodine and Methyl salicylate ointment. Dispensing of cold cream and vanishing creams.

Cosmetics: Lipstick, talcum powder, after shave lotion, shaving cream.(Note: A minimum of 20 practicals will be conducted).

Health Science Research Project: In the area of health care system, community pharmacy. Establishment of DIC, PCC.

Recommended Books:

PHARMACY PRACTICE (DISPENSING PHARMACY)

1. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals.** 1st Ed. Taylor & Francis Publishers; 1990.
2. Gennaro AR. **Remington: The science and practice of pharmacy.** 21st Ed. Lippincott Williams & Wilkins; 2011.

3. Marriott JF, Wilson KA, Langley CA, Belcher D. **Pharmaceutical compounding and dispensing**. 2nd Ed. Pharmaceutical Press; 2010.
4. Cooper JW, Gunn C, Carter SJ. **Cooper and Gun's Dispensing for Pharmaceutical Students**. 12th Ed. CBS Publishers & Distributors; 2008.
5. Lund W. **The Pharmaceutical Codex: Principles and practice of pharmaceutics**. 16th Ed. Co CBS Publishers; 2009.
6. Mehta DK. **British national formulary (BNF)**. 54th Ed. Pharmaceutical Press; 2007.
7. Rowe RC. **Handbook of pharmaceutical excipients**. 6th Ed. Pharmaceutical press; 2009.
8. Winfield AJ, Rees J, Smith I. **Pharmaceutical Practice**. 4th Ed. Churchill Livingstone; 2009.

PHARMACEUTICAL CHEMISTRY-III A (Pharmaceutical Analysis) [THEORY] PHARM 512 Cr. Hr. 03

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

1. **SPECTROSCOPIC METHODS:** Theory, Instrumentation and Pharmaceutical Applications of the following Spectroscopic Methods:
 - a. Atomic Absorption and Emission Spectroscopy
 - b. Molecular Fluorescence Spectroscopy
 - c. Flame Photometry
 - d. I.R. Spectroscopy
 - e. Mass Spectroscopy
 - f. NMR Spectroscopy
 - g. U.V./Visible Spectroscopy
2. **CHROMATOGRAPHIC METHODS:** Column Chromatography, Thin Layer Chromatography, Gas Liquid Chromatography, HPLC, LCMS, GCMS, Capillary Electrophoresis.

PHARMACEUTICAL CHEMISTRY-III A (Pharmaceutical Analysis) [PRACTICAL] PHARM 513 Cr. Hr. 01
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NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. determination of the purity and composition of the unknown drugs by using at least each of the above techniques. (A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACEUTICAL CHEMISTRY (PHARMACEUTICAL ANALYSIS)

1. Ahuja S, Scypinski S. **Handbook of modern pharmaceutical analysis**. 2nd Ed. Academic Press; 2010.
2. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceutics**. 1st Ed. Taylor & Francis Publishers; 1990.
3. Beckett AH, Stenlake JB. **Practical Pharmaceutical Chemistry**. 4th Ed. The Aulton Press; 2001.

4. Braithwaite A, Smith FJ. **Chromatographic Methods**. 5th Ed. Chapman and Hall; 1995.
5. Brittain HG. **Spectroscopy of pharmaceutical solids**. 1st Ed. Taylor & Francis; 2006.
6. Hamilton R, Sewell PA. **Introduction to HPLC**. 1st Ed. Chapman & Hall; 1982.
7. Heftmann E. **Chromatography**. 6th Ed. Von Nostrand Reinheld Co; 2004.
8. Kazakevich Y, LoBrutto R. **HPLC for pharmaceutical scientists**. 1st Ed. John Wiley and Sons; 2007.
9. Kemp W. **Organic Spectroscopy**. 3rd Ed. Ellsi Horwood; 2008.
10. Knevel AM, Digangi FE. **Jenkin's quantitative Pharmaceutical Chemistry**. 7th Ed. McGraw Hill; 1977.
11. Lough WJ, Wainer WI. **High Performance Liquid Chromatography**. 1st Ed. Blacki Academic Press; 1995.
12. Moffat AC, Osselton DM, Widdop B. **Clarke's Analysis of Drugs and Poisons**. 4th Ed. Pharmaceutical Press; 2011.
13. Pryde A, Gilbert MJ. **Applications of High Performance Liquid Chromatography**. 1st Ed. Chapman & Hall; 1979.
14. Snyder LR, Kirkland JJ, Dolan JW. **Introduction to modern liquid chromatography**. 3rd Ed. John Wiley & Sons Inc; 2009.
15. Stahl E. **Thin Layer Chromatography**. 2nd Ed. Berlin: Springer Verlag; 1969. 16. Williams DH, Fleming I. **Spectroscopic methods in organic chemistry**. 6th Ed. McGraw Hill; 2007.

PHARMACOLOGY & THERAPEUTICS-II PHARM 514	[THEORY] Cr. Hr. 03
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1. **DRUGS ACTING ON CENTRAL NERVOUS SYSTEM:**
 - a. Sedatives & Hypnotic
 - b. Anxiolytics, antidepressants and antimanic drugs
 - c. Antiepileptics
 - d. Antiparkinsonian and drug used in other neurodegenerative diseases.
 - e. Antipsychotics
 - f. Opioid analgesics
 - g. Therapeutic gases (Oxygen, Carbon-dioxide, Nitric oxide and Helium.
 - h. Cerebral Stimulants, Medullary stimulants, Spinal Cord Stimulants.
 - i. Anesthetics: General and local
2. **NON-STEROIDAL ANTI-INFLAMMATORY DRUGS:** Disease modifying drugs, antirheumatic drugs, non-opioid analgesics and drugs used in the treatment of gout.

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

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

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

Recommended Books:

PHARMACOLOGY & THERAPEUTICS

1. Brunton L, Lazo J, Parker K. **Goodman & Gilman's Pharmacological Basis of Therapeutics**. 11th Ed. McGraw Hill Book Company; 2005.
2. Chang HM, But PPH, Yao SC, Wang LL, Yeung SCS. **Pharmacology and applications of Chinese Materia Medica**. 3rd Ed. World Scientific Pub Co Inc; 2000.
3. Ebadi M. **Pharmacology**. 3rd Ed. Little Brown & Company; 1996.
4. Harvey RA, Champe PC. **Lippincott's Illustrated Reviews: Pharmacology**. 4th Ed. Lippincott William & Wilkins; 2008.
5. Humphrey P. **Rang & Dale's Pharmacology**. 6th Ed. Churchill Livingstone; 2007.
6. Katzung BG, Masters SB, Trevor AJ. **Basic & Clinical Pharmacology**. 11th Ed. McGraw Hill; 2009.
7. Koda KMA, Young LY, Kradjan WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs**. 9th Ed. Lippincott Williams & Wilkins; 2008.

8. Laurence DR. **Clinical Pharmacology**. 8th Ed. ELBS Publishers; 1998.
9. Ritter JM, Levis LD. **A Text Book of Clinical Pharmacology**. 5th Ed. Oxford University Press; 2008.
10. Satorkar RS, Bhandarkar SD. **Pharmacology and Pharmacotherapeutics**. 19th Ed. Bombay: Popular Prakashan; 1998.
11. Tripathi JD. **Essentials of Medical Pharmacology**. 6th Ed. Jaypee Brothers; 2008.
12. Wecker L, Crespo L, Dunaway G, Faingold C, Watts S. **Brody's Human Pharmacology**. 5th Ed. Mosby Inc; 2009.

PHARMACOGNOSY-IIA (Advanced)
PHARM 516

Marks 100

[THEORY]

Cr. Hr. 03

1. **SEPARATION AND ISOLATION OF PLANT CONSTITUENTS:** Introduction and use of spectroscopic and chromatographic techniques for the identification of natural products. Description and interpretation of ultraviolet, infrared, mass, nuclear magnetic resonance (¹H-NMR and ¹³C-NMR) spectra and other advance techniques to elucidate the structure of natural products.
2. **CARBOHYDRATES AND RELATED COMPOUNDS:** Introduction and classification of carbohydrates, sugars as adjuvant in drugs, role of impurities in sugar substances.
 - a. Sucrose and Sucrose containing drugs: Sucrose, Dextrose, Liquid glucose, Fructose, Lactose, Xylose, Caramel, Starch, Inulin, Dextrine etc.
 - b. Cellulose and Cellulose Derivatives: Powdered cellulose, Microcrystalline cellulose, Methyl cellulose, Sodium Carboxy-methyl cellulose.
 - c. Gums and Mucilage: Tragacanth, Acacia, Sodium Alginate, Agar, Pectin.
3. **ALKALOIDS:** Introduction, Properties, Classification, Function of alkaloids in plants, Methods of extraction and identification tests.
 - a. Pyridine-Piperidine Alkaloids: Areca nut, Lobelia.
 - b. Tropane Alkaloids: Belladonna, 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. Steroid alkaloids: Veratrum.
 - h. Alkaloidal amines: Ephedra, Colchicum.
 - i. Purine Bases: Tea, Coffee.
4. **GLYCOSIDES:** Introduction, classification, chemistry, extraction, isolation and medicinal uses of:
 - a. Cardioactive glycosides: Digitalis, Strophanthus and White squill.
 - b. Anthraquinone glycosides: Cascara, Aloe, Rhubarb, Cochineal & 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.
6. **PLANT STEROIDS**: Introduction, extraction, isolation, nomenclature, sources and uses of bile acids, plant sterols, steroidal sapogenins, steroid hormones, withanolides and ecdysons.
 7. **LIPIDS**: Introduction, classification, source, active constituents and pharmacological uses of:
 - a. Fixed Oils: Castor oil, cotton seed oil, olive oil, peanut oil, sun flower oil, corn oil, coconut oil, almond oil, linseed oil, mustard oil, sesame oil and soybean oil.
 - b. Fats and Related Compounds: Theobroma oil and Lanolin. c. Waxes: Bees wax, carnauba wax, spermaceti and Jojoba oil.

PHARMACOGNOSY-IIA (Advanced)
PHARM 517

Marks: 50

[PRACTICAL]
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. Extraction of the active constituents of crude drugs and chemical tests for their identification. Isolation and separation of active constituents of crude drugs by paper and thin layer chromatography.

Also include the following experiments:

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

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

Recommended Books:

PHARMACOGNOSY

1. Anonymous. **Monographs of Unani Medicine**. Hamdard Foundation Pakistan; 2003.
2. Baker BM, Bender DA. **Vitamins in Medicine**. 12th Ed. Academic Press; 1982.
3. Brain KR, Turner TD. **The Practical Evaluation of Phytopharmaceuticals**. 1st Ed. Scientehnica Publishers; 1975.
4. Braun L, Cohen M. **Herbs and Natural Supplements: An Evidence Based Guide**. 3rd Ed. London: Elsevier Mosby; 2010.
5. Chauhan P. **Ayurvedic Pharmacognosy**. 1st Ed. Sonali Publications; 2007.
6. Cutler SJ, Cutler HG. **Biologically Active Natural Products: Pharmaceuticals**. 1st Ed. CRC Press Publisher; 1999.
7. Dewick PM. **Medicinal Natural Products: A Biosynthetic Approach**. 1st Ed. John Wiley & Sons; 1997.
8. Evans WC, Trease GE, Evans D. **Trease and Evan's Pharmacognosy**. 16th Ed. Elsevier Health Sciences Publisher; 2009.

9. Forhne D, Pfander HJ. **Poisonous Plants: A Hand Book for Doctors, Pharmacists, Toxicologists, Biologists and Veterinarians.** 2nd Ed. Timber Press; 2005.
10. Harborne JB, Baxter H. **The Hand Book of Natural Flavonoids.** 2nd Ed. John Willey & Son; 1999.
11. Jackson BP. **Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices.** 2nd Ed. CBS Publishers; 2005.
12. Khandelwal K. **Practical Pharmacognosy.** 8th Ed. Nirali Prakashan Publishers; 2008.
13. Lesley Braun and Marc Cohen. **Herbs and Natural Supplements: An evidence Based guide.** 3rd Ed. London: Elsevier Mosby; 2010.
14. Lockwood B. **Nutraceuticals: A Guide for Healthcare Professionals.** 2nd Ed. Pharmaceutical Press; 2007.
15. Mannito P. **Biosynthesis of Natural Products.** John Wiley & Sons; 1981.
16. Manske RHF. **Alkaloids: Chemistry and Physiology.** Academic Press; 1970.
17. Partab Chauhan. **Ayurvedic Pharmacognosy.** 1st Ed. Sonali Publications; 2007.
18. Ross IA. **Medicinal Plants of the World.** 2nd Ed. Humana Press; 2003.
19. Smith AB. **Poisonous Plants of All Countries.** 2nd Ed. Periodical Expert Book; 1988.
20. Smith AB. **Poisonous Plants of all Countries: With the Active, Chemical Principles Which They Contain; and the Toxic Symptoms Produced by Each Group.** 4th Ed. General Books LLC; 2010.
21. Tyler VE, Brady LR, Robbers JE. **Pharmacognosy.** 10th Ed. Lea and Febiger; 2001.
22. Wichtl M. **Herbal Drugs and Phytopharmaceuticals.** 3rd Ed. Medpharm Publishers; 2004.

PATHOLOGY
PHARM 518

Marks:100

[THEORY]
Cr.Hr..03

1. **SCOPE OF PATHOLOGY & CONCEPT OF DISEASES:**
2. **DEFINITION AND TERMINOLOGY:** Ischemia, Hypoxia, Necrosis, sInfarction, Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Aplasia, Anaplasia.
3. **RESPONSE OF BODY TO INJURY AND INFECTION:** Acute and Chronic inflammation, Immunity, Allergy, Hyper Sensitivity.
4. **SPECIFIC DISEASES:** Ulcer (Peptic, Duodenal), Hypertension, Leukemia or Blood Cancer (Malignant Carcinoma, Sarcoma & Lymphomas), Diagnosis and treatment of Cancer in general, fate, survival and prognosis with tumors.

PATHOLOGY
PHARM 519

Marks:50

[PRACTICAL]
Cr.Hr.01

1. **STUDY OF PATHOLOGICAL SLIDES OF VARIOUS PATHOLOGICAL CONDITIONS:**
Acute inflammation, Chronic inflammation, Chronic specific inflammation, Different types of Degeneration, Thrombosis, Embolism, Infarction, Necrosis, Gangrene, Hyperplasia, Metaplasia, Pigmentation, Calcification, CVC, Papilloma, Adenoma, Chondroma, Fibroma, Leomyoma, Neofibroma, Squamous Cell Carcinoma, Basal Cell Carcinoma, Transitional Cell

Carcinoma, Adenocarcinoma, Fibrocarcinoma, Rhabdomyo sarcoma, Leiomyo sarcoma, Lymphosarcoma, Liposarcoma, Reticular Cell Sarcoma, Hodgkins disease, Breast Carcinoma, Osteogenic Sarcoma, Osteoclastoma, Hapatitis, Diabetes.

2. **EXAMINATION OF DIFFERENT BODY FLUIDS IN VARIOUS PATHOLOGICAL CONDITIONS:**

Urine Complete Examination, Stool Examination, Blood Complete Examination, Semen Examination, Cerebrospinal Fluid Examination, Pericardial Fluid Examination, Pleural Fluid Examination, Ascitic Fluid Examination, Blood Sugar, Blood Urea, Blood Cholesterol etc.

3. **TESTS FOR VARIOUS SPECIMENS OF CLINICAL IMPORTANCE:**

Techniques of Clinical Blood Examination for various disases, Gastric Analysis, Tests for liver function, Renal function test, Tests for endocrine abnormalities, Biopsies and cytologic techniques.

Recommended Books:

PATHOLOGY

1. Dipiro J, Talbert RL, Yee G, Matzke G, Wells B, Michael PL. **Pharmacotherapy: A Pathophysiologic Approach.** 8th Ed. McGraw Hill; 2011.
2. Greene RJ, Harris ND. **Pathology and therapeutics for pharmacists.** 3rd Ed. Pharmaceutical press; 2008.
3. Kumar V, Cotran RS, Robbins SL. **Robbin's Basic Pathology.** 8th Ed. W. B. Saunders Publishers; 2007.
4. Macfarlane PS, Reid R, Collander R. **Pathology Illustrated.** 5th Ed. Churchill Livingstone; 2000.
5. Walter GB. **Walters and Israel General Pathology.** 7th Ed. Churchill Livingstone; 1996.

SECOND SEMESTER

PHARMACY PRACTICE-IIB (Community, Social & Administrative Pharmacy)

PHARM 520

Marks: 100

Cr. Hr. 03

1. **DEFINITIONS AND BACKGROUND:**

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

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

4. **PATIENT EDUCATION AND COUNSELLING:**

5. **CONTROL OF DRUG ABUSE AND MISUSE:**

6. **ROLE OF PHARMACIST:** As Public Health Educator in the Community for Drug Monitoring and Drug Information.
7. **HEALTH SYSTEM RESEARCH:** Knowledge skills of research methods, epidemiologic study design, experimental study design, Pre- and post-marketing surveys. Application of various statistical procedures in Pharmacy and Medical Research, causality assessment as well as the sensitivity and specificity tests in pharmacy practice.
8. **PHARMACOECONOMICS:** Pharmacoeconomic modeling & interpretation.
9. **ALTERNATIVE THERAPIES:** Background, philosophy and use of complementary and alternative therapies including herbal medicines, homoeopathy, acupuncture, acupressure, Bach Flower remedies, aromatherapy and reflexology.
10. **PHARMACY LAYOUT DESIGN:** Objectives of Layout Design, Types of Community Pharmacies (Pharmaceutical Centre, Prescription-oriented Pharmacies, Traditional Pharmacies and The Super Drug Store), Consumer goods and purchases, Classes of Layout designs, Principles and characteristics of Layout Design and Traffic Flow analysis.

Recommended Books:

PHARMACY PRACTICE (COMMUNITY, SOCIAL & ADMINISTRATIVE PHARMACY)

1. Allen LV, Popovich NG, Ansel HC. **Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.** 9th Ed. Lippincott Williams & Wilkins; 2010.
2. Armstrong NA, James KC. **Understanding Experimental Design and Interpretation in Pharmaceutics.** 1st Ed. Taylor & Francis publishers; 1990.
3. Cooper JW, Gunn C, Carter SJ. **Cooper and Gun's Dispensing for Pharmaceutical Students.** 12th Ed. CBS Publishers & Distributors; 2008.
4. Desselle SP, Zgarrick DP. **Pharmacy Management: Essentials for all Practice Settings.** 2nd Ed. McGraw Hill; 2008.
5. Gennaro AR. **Remington: The science and Practice of Pharmacy.** 21st Ed. Lippincott Williams & Wilkins; 2011.
6. Lund W. **The pharmaceutical Codex: Principles and Practice of Pharmaceutics.** 16th Ed. Co. CBS Publishers; 2009.
7. Marriott JF, Wilson KA, Langley CA, Belcher D. **Pharmaceutical Compounding and Dispensing.** 2nd Ed. Pharmaceutical Press; 2010.
8. Martindale W, Westcoot W. **Martindale: The Complete Drug Reference.** 1st Ed. Pharmaceutical Press; 2008.
9. Mehta DK. **British National Formulary (BNF).** 54th Ed. Pharmaceutical Press; 2007.
10. O'Donohue WT, Levensky ER. **Promoting Treatment Adherence: A practical handbook for health care providers.** 1st Ed. Sage Publications; 2006.
11. Osol A. **Remington's Pharmaceutical Sciences.** 17th Ed. Mack Publishing Company; 2001.
12. Spivey RN, Wertheimer AI, Donald RT. **International pharmaceutical services: The Drug**

- Industry and Pharmacy Practice in Twenty Three Major Countries of the World. 1st Ed. Informa Healthcare; 1996.
13. Robertson R. **Management of Drug Users in the Community: A practical Handbook.** 1st Ed. Hodder Arnold Publishers; 1998.
 14. Rowe RC. **Handbook of Pharmaceutical Excipients.** 6th Ed. Pharmaceutical Press; 2009.
 15. Saha GB. **Fundamentals of Nuclear Pharmacy.** 6th Ed. Springer Verlag; 2010. 16. Desselle SP, Zgarrick DP. **Pharmacy management: Essentials for all practice settings.** 2nd Ed. McGraw Hill; 2008.
 17. Spivey RN, Wertheimer AI, Donald RT. **International Pharmaceutical Services: The Drug Industry and Pharmacy Practice in Twenty Three Major Countries of the World.** 1st Ed. Informa Healthcare; 1996.
 18. Martindale W, Westcoot W. **Martindale: The Extra Pharmacopeia.** 31st Ed. Pharmaceutical Press; 2008.
 19. O'Donohue WT, Levensky ER. **Promoting treatment adherence: A practical handbook for health care providers.** 1st Ed. Sage Publications; 2006.
 20. Winfield AJ, Rees J, Smith I. **Pharmaceutical Practice.** 4th Ed. Churchill Livingstone; 2009.

PHARMACEUTICAL CHEMISTRY-IIIB (Pharm. Analysis)	[THEORY] PHARM 522
Marks: 100	Cr. Hr. 03

1. **ELECTRO CHEMICAL METHODS:** Potentiometry, Polarography and Radiochemical Techniques.
2. **THERMAL ANALYSIS:** Differential Scanning Calorimetry, Differential Thermal Analysis, Thermo Gravimetric Analysis.
3. **TITRIMETRIC ANALYSIS:** Titrimetric analysis of drugs based on neutralization, hydrolysis, oxidation, reduction and non-aqueous titration.
4. **OCCURENCE, PROPERTIES, PREPARATION AND APPLICATION OF OFFICIAL INORGANIC COMPOUNDS:** Aluminium Hydroxide, Ammonium Chloride, Sodium Carbonate, Magnesium Carbonate, Lithium Carbonate, Sodium Nitrite, Calcium Gluconate, Antimony Gluconate, Ferrous Fumarate, Ferrous Sulfate and Silver Nitrate.

PHARMACEUTICAL CHEMISTRY-IIIB (Pharm. Analysis)
[PRACTICAL] PHARM 523
Marks: 50
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 requirements, e.g. determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques.

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

Recommended Books:

PHARMACEUTICAL CHEMISTRY (PHARMACEUTICAL ANALYSIS)

1. Ahuja S, Scypinski S. **Handbook of modern pharmaceutical analysis.** 2nd Ed. Academic Press; 2010.

2. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals**. 1st Ed. Taylor & Francis Publishers; 1990.
3. Beckett AH, Stenlake JB. **Practical Pharmaceutical Chemistry**. 4th Ed. The Aulton Press; 2001.
4. Braithwaite A, Smith FJ. **Chromatographic Methods**. 5th Ed. Chapman and Hall; 1995.
5. Brittain HG. **Spectroscopy of pharmaceutical solids**. 1st Ed. Taylor & Francis; 2006.
6. Hamilton R, Sewell PA. **Introduction to HPLC**. 1st Ed. Chapman & Hall; 1982.
7. Heftmann E. **Chromatography**. 6th Ed. Von Nostrand Reinhold Co; 2004.
8. Kazakevich Y, LoBrutto R. **HPLC for pharmaceutical scientists**. 1st Ed. John Wiley and Sons; 2007.
9. Kemp W. **Organic Spectroscopy**. 3rd Ed. Ellsi Horwood; 2008.
10. Knevel AM, Digangi FE. **Jenkin's quantitative Pharmaceutical Chemistry**. 7th Ed. McGraw Hill; 1977.
11. Lough WJ, Wainer WI. **High Performance Liquid Chromatography**. 1st Ed. Blacki Academic Press; 1995.
12. Moffat AC, Osselton DM, Widdop B. **Clarke's Analysis of Drugs and Poisons**. 4th Ed. Pharmaceutical Press; 2011.
13. PrydeA, Gilbert MJ. **Applications of HighPerformance Liquid Chromatography**. 1st Ed. Chapman & Hall; 1979.
14. Snyder LR, Kirkland JJ, Dolan JW. **Introduction to modern liquid chromatography**. 3rd Ed. John Wiley & Sons Inc; 2009.
15. Stahl E. **Thin Layer Chromatography**. 2nd Ed. Berlin: Springer Verlag; 1969. 16. Williams DH, FlemingI. **Spectroscopic methods in organic chemistry**. 6th Ed. McGraw Hill; 2007.

PHARMACOLOGY & THERAPEUTICS-IIB
PHARM 524

Marks: 100

[THEORY]
Cr.Hr.03

1. **CHEMOTHERAPY:**

- a) Basic principles of chemotherapy.
- b) Antibacterials: (Folate antagonists; sulphonamides. Cell wall synthesis inhibitors; Penicillin, Cephalosporins, Carbapenam, Monobactam. Protein synthesis inhibitors; Aminoglycosides, Tetracyclines, Chloramphenicol, Macrolides. Nucleic acid synthesis inhibitors; Quinolones and miscellaneous Antibiotics), Antimycobacterial drugs, Urinary tract antiseptics.
- c) Anti-fungals: d) Anti-virals:
- e) Anti-protozoals: (anti-malarias, anti-amebiasis, anthelmintics and anti-leishmanials).
- f) Anti-neoplastic drugs:

2. **IMMUNOPHARMACOLOGY:** Pharmacology of stimulants.

3. **TOXICOLOGY:**

- (a) Pollution and its types (water, air, food) immuno-suppressants and
- (b) Poison and principle of treatment of poisoning.
- (c) Poisoning (Sign & symptom and treatment): Ethanol, Digitalis, Salicylates, Strychnine, Narcotics, Nicotine, Benzodiazepines and organophosphorous compounds. Barbiturates, Paracetamol
- (d) Chelating agents and their role Calciumdisodium edentate (Calcium Defroxamine in poisoning: Dimercaprol, EDTA), Pencillamine and

NOTE:

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

PHARMACOLOGY & THERAPEUTICS-IIB
PHARM 525

Marks: 50

[PRACTICAL]
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.

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

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

Recommended Books:**PHARMACOLOGY & THERAPEUTICS**

1. Brunton L, Lazo J, Parker K. **Goodman & Gilman's Pharmacological Basis of Therapeutics.** 11th Ed. McGraw Hill Book Company; 2005.

2. Chang HM, But PPH, Yao SC, Wang LL, Yeung SCS. **Pharmacology and applications of Chinese Materia Medica**. 3rd Ed. World Scientific Pub Co Inc; 2000.
3. Ebadi M. **Pharmacology**. 3rd Ed. Little Brown & Company; 1996.
4. Harvey RA, Champe PC. **Lippincott's Illustrated Reviews: Pharmacology**. 4th Ed. Lippincott William & Wilkins; 2008.
5. Humphrey P. **Rang & Dale's Pharmacology**. 6th Ed. Churchill Livingstone; 2007.
6. Katzung BG, Masters SB, Trevor AJ. **Basic & Clinical Pharmacology**. 11th Ed. McGraw Hill; 2009.
7. Koda KMA, Young LY, Kradjan WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs**. 9th Ed. Lippincott Williams & Wilkins; 2008.
8. Laurence DR. **Clinical Pharmacology**. 8th Ed. ELBS Publishers; 1998.
9. Ritter JM, Levis LD. **A Text Book of Clinical Pharmacology**. 5th Ed. Oxford University Press; 2008.
10. Satorkar RS, Bhandarkar SD. **Pharmacology and Pharmacotherapeutics**. 19th Ed. Bombay: Popular Prakashan; 1998.
11. Tripathi JD. **Essentials of Medical Pharmacology**. 6th Ed. Jaypee Brothers; 2008.
12. Wecker L, Crespo L, Dunaway G, Faingold C, Watts S. **Brody's Human Pharmacology**. 5th Ed. Mosby Inc; 2009.

PHARMACOGNOSY-IIB (Advanced)
PHARM 526

Marks: 100

[THEORY]
Cr.Hr.03

1. **VOLATILE OILS (ESSENTIAL OILS):** Introduction, significance, sources, active constituents, methods of obtaining volatile oils, chemistry and classification of:
 - (a) Hydrocarbon volatile oils: Cubeb and Turpentine oil.
 - (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) Miscellaneous volatile oils: Allium, Anethum.
2. **RESINS AND OLEORESINS:** Introduction, classification, active constituents and pharmacological uses of jalap, turpentine, asafoetida, benzoin, rosin, cannabis, podophyllum, ipomea, myrrh, and balsam.
3. **TANNINS:** Introduction, classification, biosynthesis, extraction, identification, occurrence in plants, their role in plant life and chemical study of tannins in kino, myrobalan, catechu, nutgall, castanea, and krameria.
4. **NATURAL TOXICANTS:**
 - a) General Introduction to Plant Toxicology: Definition, classification and chemical nature of plant toxins. Plant toxicities in humans and animals

- b) Higher Plant Toxins: Essential oils: Terpene (cineol, pine oil), Phenyl propane (apiol, safrole, myristicin), Monoterpene (thujone, menthafuran) Plant acids (oxalic acid, amino acid, resin acid), Glycosides (cardiotonic, cyanogenic), Alkaloids (imidazole, pyrrolizidine, tropane).
- c) Lower Plant Toxins: Bacterial toxins (Staphylococcus aureus, Clostridium botulinum), Algal toxins (Microcystis aeruginosa, Cyanobacteria, Gonyaulax cantenella).
- d) Mycotoxins:Fungal toxins (Aspergillus spp., Claviceps purpurea), Mushrooms (Amanita spp.).
- e) Study of Toxins, their Prevention and Control Methods: Description, pharmacognostic features, pharmacological actions, chemical constituents, treatment, side-effects, contra-indications, warnings, prevention and control methods of Abrus precatorius, Papaver somniferum, Eucalyptus spp., Nicotiana tabaccum, Cannabis sativa, Digitalis purpurea, Datura stramonium poisoning.

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

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

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

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

Diabetes:*Gymnema sylvestre, Melia azadirchta, Momordicacharantia, Syzygium jambulana.*

Cardiac diseases:*Digitalis spp., Convallaria majalis, Urgenia indica, Allium sativum, Punica granatum.*

Hepatitis:*Berberis vulgaris, Picrorhiza kurroa, Lawsonia innermis.* Respiratory diseases:*Ficus religosa, Adhatoda vasica.*

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

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

Musculo-skeletal disorders:*Nigella sativa, Phycotis ajowan, Trigonella foenum--graecum, Zingiber officinale.*

Renal disorders:*Cucumis melo, Berberis vulgaris, Zea mays, Tribulus terrestris.* Reproductive disorders:*Saraca indica, Ruta graveolens, Nigella sativa, Glycyrrhiza glabra, Claviceps purpurea, Myristica fragrance.*

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

PHARMACOGNOSY-IIB (Advanced)
PHARM 527

Marks: 50

[PRACTICAL]
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. extraction of the active constituents of crude drugs and chemical tests for their identification. Isolation and separation of active constituents of crude drugs by paper chromatography and thin layer chromatography.

Also include the following experiments:

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

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

Recommended Books:

PHARMACOGNOSY

1. Anonymous. **Monographs of Unani Medicine**. Hamdard Foundation Pakistan; 2003.
2. Baker BM, Bender DA. **Vitamins in Medicine**. 12th Ed. Academic Press; 1982.
3. Brain KR, Turner TD. **The Practical Evaluation of Phytopharmaceuticals**. 1st Ed. Scientehnica Publishers; 1975.
4. Braun L, Cohen M. **Herbs and Natural Supplements: An Evidence Based Guide**. 3rd Ed. London: Elsevier Mosby; 2010.
5. Chauhan P. **Ayurvedic Pharmacognosy**. 1st Ed. Sonali Publications; 2007.
6. Cutler SJ, Cutler HG. **Biologically Active Natural Products: Pharmaceuticals**. 1st Ed. CRC Press Publisher; 1999.
7. Dewick PM. **Medicinal Natural Products: A Biosynthetic Approach**. 1st Ed. John Wiley & Sons; 1997.
8. Evans WC, Trease GE, Evans D. **Trease and Evan's Pharmacognosy**. 16th Ed. Elsevier Health Sciences Publisher; 2009.
9. Forhne D, Pfander HJ. **Poisonous Plants: A Hand Book for Doctors, Pharmacists, Toxicologists, Biologists and Veterinarians**. 2nd Ed. Timber Press; 2005.
10. Harborne JB, Baxter H. **The Hand Book of Natural Flavonoids**. 2nd Ed. John Willey & Son; 1999.
11. Jackson BP. **Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices**. 2nd Ed. CBS Publishers; 2005.
12. Khandelwal K. **Practical Pharmacognosy**. 8th Ed. Nirali Prakashan Publishers; 2008.
13. Lesley Braun and Marc Cohen. **Herbs and Natural Supplements: An evidence Based guide**. 3rd Ed. London: Elsevier Mosby; 2010.
14. Lockwood B. **Nutraceuticals: A Guide for Healthcare Professionals**. 2nd Ed. Pharmaceutical Press; 2007.
15. Mannito P. **Biosynthesis of Natural Products**. John Wiley & Sons; 1981.
16. Manske RHF. **Alkaloids: Chemistry and Physiology**. Academic Press; 1970.
17. Partab Chauhan. **Ayurvedic Pharmacognosy**. 1st Ed. Sonali Publications; 2007.
18. Ross IA. **Medicinal Plants of the World**. 2nd Ed. Humana Press; 2003.
19. Smith AB. **Poisonous Plants of All Countries**. 2nd Ed. Periodical Expert Book; 1988.
20. Smith AB. **Poisonous Plants of all Countries: With the Active, Chemical Principles Which They Contain; and the Toxic Symptoms Produced by Each Group**. 4th Ed. General Books LLC; 2010.
21. Tyler VE, Brady LR, Robbers JE. **Pharmacognosy**. 10th Ed. Lea and Febiger; 2001.
22. Wichtl M. **Herbal Drugs and Phytopharmaceuticals**. 3rd Ed. Medpharm Publishers; 2004.

1. **FUNDAMENTALS OF COMPUTERS:**
 - a. History of Data Processing
 - b. Types of Computers
 - c. Components of a Computer
 - d. Computer System and Business Computer System
 - e. Backing Storage Devices
 - f. Unit of Memory
 - g. Viruses and Anti-viruses Issues
2. **RESEARCH METHODOLOGIES:**
3. **SYSTEM ANALYSIS AND DESIGN:**
 - a. What is a System?
 - b. Steps in system life cycle
 - c. Data Gathering and Data Analysis
 - d. Designing a New System
 - e. Development and Implementation of New System
 - f. Documentation.
4. **DATA PROCESSING:**
 - a. Data Processing
 - b. The Data Processing Cycle
 - c. The Collection and Computing of data
 - d. Manual collection of data
 - e. The main methods of data input
 - f. Devices used to collect data
 - g. Data Verification
 - h. Data Validation
 - i. Output and Recording of data
 - j. Types of data processing systems
 - k. Types of Computer Operation
 - l. Batch Processing and Real-time Processing
5. **APPLICATION OF COMPUTERS IN HOSPITAL PHARMACY:**
 - a. Patterns of Computer use in Hospital Pharmacy
 - b. Patient record database management
 - c. Medication order entry
 - d. Drug labels and list
 - e. Intravenous solution and admixture
 - f. Patient Medication profiles
 - g. Inventory control
 - h. Management report & Statistics
6. **APPLICATION OF COMPUTER IN COMMUNITY PHARMACY:**
 - a. Computerizing the Prescription Dispensing process,
 - b. Use of Computers for Pharmaceutical Care in community pharmacy,
 - c. Accounting and General ledger system.
7. **APPLICATION OF DRUG INFORMATION RETRIEVAL & STORAGE:**
 - a. Introduction

- b. Advantages of Computerized Literature
- c. Retrieval use of Computerized Retrieval

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

PHARMACY PRACTICE-III (Computer and its applications in Pharmacy)	[RACTICAL]
PHARM 529	Marks: 50
	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, Favourites, security and Customizing Explorer.
2. **WEB PAGE DEVELOPMENT**: Introduction to Front-page, Creating a First Web site, Basic Formatting Techniques, Manipulating Tables within Front-page, Front-page, Picture and MultiMedia, Hyper linking, Bookmarks and Image Maps, Introducing Front-page “components”, Front-page and Frames, Managing your Web, Good site design, Publishing and publicizing.
3. **DATA PRESENTATION SKILLS**: MS-Word, MS-Excel, MS-Power point.
4. **UNDERSTANDING AND APPLICATION OF STATISTICAL PACKAGES**: SPSS, Kinetica, Med Calc.

Recommended Books:

PHARMACY PRACTICE (COMPUTER AND ITS APPLICATIONS IN PHARMACY)

1. Dennis N. **Programmer's Guide to MS-DOS**. 2nd Ed. BradyGames; 1987.
2. Elias M. **System Analysis and design**. 2nd Ed. Award Galgotia Publications; 1985.
3. Norton P, Clark S. **Peter Norton's Complete Guide to DOS 6.22**. 1st Ed. Sams Publishers; 1994.
4. Norton P, Clark S. **Peter Norton's New Inside the PC**. 1st Ed. Sams Publishers; 2002.

FOURTH PROFESSIONAL

FIRST SEMESTER

PHARMACY PRACTICE-IVA (HOSPITAL PHARMACY)

PHARM 610

Marks:100

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. Organizational Pattern
- c. Administration
- d. Clinical Departments
- e. Nursing, Dietetic, Pathology, Blood Bank, Radiology and other supportive services
- f. Role of Pharmacy in Hospital
- g. Hospital Finances

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 Professional and other departmental staff
- f. Professional services rendered

4. **PHARMACY AND THERAPEUTIC COMMITTEE:**

5. **THE HOSPITAL FORMULARY:**

- a. General Principles and guidelines to develop Formulary
- b. Format
- c. Preparation of the Formulary
- d. Role of Pharmacist
- e. Benefits and problems
- f. Keeping up to date Formulary

6. **DISPENSING TO INPATIENTS:**

- a. Methods of Dispensing & SOP's
- b. Unit dose dispensing
- c. Other concepts of dispensing, Satellite Pharmacy etc.

7. **DISPENSING TO AMBULATORY PATIENTS:**

8. **DISTRIBUTION OF CONTROL SUBSTANCES:**

9. **DISPENSING DURING OFF-HOURS:**
10. **SAFE USE OF MEDICATION IN THE HOSPITAL:** Medication error; Evaluation & Precautions of Medication Error; Role of Pharmacist in Controlling Medication Error.

Recommended Books:

PHARMACY PRACTICE (HOSPITAL PHARMACY)

1. Bukhari NI. **Hospital Pharmacy**. 1st Ed. Aziz Book Depot; 2000.
2. HassanW. **Hospital Pharmacy**. 5th Ed. Lee & Febiger; 1986.
3. StephenM. **Hospital Pharmacy**. 2nd Ed. Pharmaceutical Press; 2001.

PHARMACY PRACTICE-VA (CLINICAL PHARMACY-I) [THEORY] PHARM 612 Marks:100 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.
 - General guidelines for clinical pharmacy practice.
 - Patient Counseling Compliance
 - Laboratory Data interpretation
 - Electrolytes management
 - Clinical literature evaluation
 - Drug interactions
 - Medication errors
2. **PATIENT PROFILE & PATIENT COUNSELING:**
 - a. Patient disease profile
 - b. Taking case history
 - c. Drug Profile of atleast 25 Important Medications e.g. Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cephalosporins, Chlorpheniramine, Cimetidine, Digoxin, Dobutamine, Dopamine, Fluroquinolone, Frusemide, Lactulose, Macrolides, Metoclopramide, Morphine/Pethedine, Nifedipine, NSAIDS, ORS, Penicillins, Prednisolone, Salbutamol, Vancomycin.
 - d. Patient Counseling
3. **CLINICAL TRIALS OF DRUG SUBSTANCES:** Designing of clinical trials, Types of trials, Choice of patients, Exclusion of patients and Monitoring a clinical trial.
4. **EMERGENCY TREATMENT:** For example, Cardiopulmonary resuscitation (CPR), Cold Blue.
5. **DRUG INTERACTIONS:** Mechanism, Physiological factors affecting interaction, Types and level of drug interactions, Role of pharmacist in evaluating drug interaction & its management.

6. **PHARMACOVIGILANCE:**

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

PHARMACY PRACTICE-VA (CLINICAL PHARMACY-I) [PRACTICAL]
PHARM 613
Marks:50
Cr. Hr. 01

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

Recommended Books:

PHARMACY PRACTICE (CLINICAL PHARMACY)

1. DiPiro JT. **Encyclopedia of Clinical Pharmacy**. 1st Ed. Informa Healthcare; 2002.
2. DiPiro JT. **Pharmacotherapy, A Pathophysiologic Approach**. McGraw Hill Companies, South Carolina; 2008.
3. Gennaro AR. **Remington: The science and practice of pharmacy**. 21st Ed. Lippincott Williams & Wilkins; 2011.
4. Gourley H. **Clinical Pharmacy & Therapeutics**. 4th Ed. William & Willkins; 1992.
5. Greene RJ, Harris ND. **Pathology and therapeutics for pharmacists**. Pharmaceutical Press; 2008.
6. Hansen K, Parthasarathi G. **Text Book of Clinical Pharmacy**. 2nd Ed. Orient Blackswan; 2008.
7. Hansten P, Horn J. **Drug interactions Analysis and Management**. 5th Ed. Lippincott Williams & Wilkins; 2010.
8. Koda-Kimble MA, Young LY, Kradjan WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs**. Lippincott Williams & Wilkins Baltimore; 2005.
9. Paul G. **A Behavioral Approach to Pharmacy Practice**. 1st Ed. Black Well; 2000.
10. Rantucci MJ. **Pharmacist Talking with Patients: A Guide to Patient Counseling**. 2nd Ed. Lippincott Williams & Wilkins; 2006.
11. RitschelWA, Kearns GL. **Handbook of Basic Pharmacokinetics: Including Clinical applications**. 7th Ed. American Pharmacists Association; 2009.
12. Robinson M, CookS. **Clinical Trials: Risk Management**. 3rd Ed. Churchill Livingstone; 2009.
13. Rosenbaun D. **Clinical Research Coordinator Hand Book**. 4th Ed. Sarrison, Inc; 2001.
14. Smith GDG, Aronson JK. **Oxford Text Book of Clinical Pharmacology and Drug Therapy**. 3rdEd.OxfordUniversity Press; 2002.

15. Sweetman S. **Martindale: The complete drug reference.** 37th Ed. Pharmaceutical Press. 2011.
16. Taylor K, Harding G. **Pharmacy Practice.** 1st Ed. CRC Press; 2001.
17. Unschuld PU. **Medicine in China: a history of ideas.** 2nd Ed. Univ of California Press; 2010.
18. Walker R. **Clinical Pharmacy & Therapeutics.** 4th Ed. Churchill Livingstone; 2003.
19. Winfield AJ, Rees J, Smith I. **Pharmaceutical practice.** 4th Ed. Churchill Livingstone; 2009.
20. Winter ME. **Basic Clinical Pharmacokinetics.** 5th Ed. Lippincott Williams & Wilkins; 2009.
21. Zinc G. **Remington: The Science and Practice of Pharmacy.** Philadelphia College of Pharmacy and Science: New York 1157; 2005.

PHARMACEUTICS-IVA (INDUSTRIAL PHARMACY) [THEORY]
PHARM 614
Marks:100
Cr. Hr. 03

1. **MASS TRANSFER:**
2. **HEAT TRANSFER:**
3. **DRYING:** Theories of drying, Drying of Solids, Classification of dryers, General Methods, Fluidized Bed systems, Pneumatic systems, Spray dryer, Freeze drying.
4. **COMMUNITION (SIZE REDUCTION):** Reasons for size reduction, Factors affecting size reduction, size analysis, Sieving, Energy Mills (Ball Mill, Endrumer, Edge Rumer, Disintegrant, Colloid Mill, Hammer Mill, Cutter Mill and Fluid Energy Mill etc).
5. **MIXING:** Fundamentals, Mechanisms, Mixing Equipment used in Liquid/Liquid, Liquid/Solid and Solid/Solid mixing.
6. **CLARIFICATION AND FILTRATION:** Theory, Filter Media, Filter aids, Filter selection and Equipment (Leaf filter, Filter press, Melta filters and Rotary filters).
7. **EVAPORATION:** General principles of Evaporation, Evaporators and Evaporation under reduced pressure.
8. **COMPRESSION AND COMPACTION:** The solid-air Interface, Angle of Repose, Flow rates, Mass volume relationship, Density, Heckel Plots, Consolidation, Granulation, Friability, Compression (dry method, wet method, slugging), Physics of Tableting, tableting machines and other equipment required, problems involved in tableting, tablet coating. Capsulation: Hard and soft gelatin capsules

PHARMACEUTICS-IVA (INDUSTRIAL PHARMACY) [PRACTICAL]
PHARM 615
Marks:50
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. Manufacture of Tablets by Wet Granulation Method, by Slugging and by Direct Compression. Coating of Tablets (Sugar Coating, Film coating and Enteric Coating). Clarification of liquids by various processes. Size Reduction. Homogenization. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables. Capsule filling by semi automatic machines. Manufacture of sustained action drugs. Tablets Tests like Disintegration. Dissolution. Friability. Hardness and Thickness tests. Determination of weight variation in tablets. Density of powder. Particle size analysis. (Note: A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACEUTICS (INDUSTRIAL PHARMACY)

1. Allen LV, Popovich NG. **Ansel's pharmaceutical dosage forms and drug delivery systems.** 8th Ed. Lippincott Williams & Wilkins New York; 2005.
2. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals.** 1st Ed. Taylor & Francis Publishers; 1990.
3. Osol A. **Remington's Pharmaceutical Sciences.** 21st Ed. Mack Publishing Company; 2005.
4. Aulton ME. **Aulton's pharmaceuticals: the design and manufacture of medicines.** 3rd Ed. Churchill Livingstone; 2007.
5. Cooper JW, Gunn C, Carter SJ. **Cooper and Gunn's Tutorial Pharmacy.** 6th Ed. CBS Publishers & Distributors; 2004.
6. Davis H. **Bentley's Text Book of Pharmaceutics.** 2nd Ed. Tindall and Cox Publishers; 1961.
7. Dukes MNG. **The Law and Ethics of the Pharmaceutical Industry.** 1st Ed. Elsevier Science; 2005.
8. Gambardella A. **Science and innovation: The US pharmaceutical industry during the 1980.** 1st Ed. Cambridge Univ Press; 2008.
9. Gennaro AR. **Remington: The Science and Practice of Pharmacy.** 21st Ed. Lippincott Williams & Wilkins; 2011.
10. Ghosh TK, Jasti BR. **Theory and practice of contemporary pharmaceuticals.** 1st Ed. CRC Press; 2005.
11. Lachman L, Lieberman HA, Kanig JL. **Theory and Practice of Industrial Pharmacy.** 3rd Ed. Verghese Publishing House; 2009.
12. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design.** 1st Ed. Informa HealthCare; 1998.
13. Martindale W, Westcoot W. **Martindale's Extra Pharmacopoeia.** 1st Ed. Pharmaceutical Press; 2008.
14. Sharp J. **Good Pharmaceutical Manufacturing Practice.** 6th Ed. Rational and Compliance; 2009.
15. Sinko PJ, Martin AN. **Martin's physical pharmacy and pharmaceutical sciences: physical chemical and biopharmaceutical principles in the pharmaceutical sciences.** 5th Ed. Lippincott Williams & Wilkins; 2006.
16. Watt PR. **Tablet Machine Instrumentation in Pharmaceutics: principles and practice.** 2nd Ed. Ellis Horwood Ltd; 1988.
17. Winfield AJ, Richards RME. **Pharmaceutical practice.** 3rd Ed. Elsevier Health Sciences; 2004.

1. **DEFINITIONS AND TERMINOLOGY:** Biopharmaceutics, Generic Equivalence, Therapeutic Equivalents, Bioavailability, Bioequivalence, Drug Disposition, Pharmacokinetics (LADMER; Liberation, absorption, distribution, metabolism, elimination and response).
2. **GASTRO-INTESTINAL ABSORPTION:** Forces which help in transmembrane movements, Anatomical and physiological factors influencing absorption of drugs. Physicochemical properties of drugs affecting absorption. Absorption of different oral dosage forms.
3. **BIOLOGICAL HALF LIFE AND VOLUME OF DISTRIBUTION:** Introduction, types, methods of determination and application.
4. **DRUG CLEARANCE:** Introduction, Mechanism, Models, determination and relationship of clearance with half-life.
5. **PHARMACOKINETICS:** Introduction, Linear and Non-linear Pharmacokinetics Application of pharmacokinetics in clinical situations.
6. **MULTIPLE DOSAGE REGIMEN:**
 - a. Introduction, principles of superposition
 - b. Factors: persistent, accumulation and loss factors
 - c. Repetitive Intravenous injections – One Compartment Open Model
 - d. Repetitive Extravascular dosing – One Compartment Open model
 - e. Multiple Dose Regimen – Two Compartment Open Model
7. **CONCEPT OF COMPARTMENT(S) MODELS:**
 - I. One compartment open model.
 - a. Intravenous Injection (Bolus)
 - b. Intravenous infusion.
 - II. Multicompartment models.
 - a. Two compartment open model.
 - b. IV bolus, IV infusion and oral administration
 - III. Non-compartmental Model.
 - a. Statistical Moment Theory
 - b. MRT for various compartment models
 - c. Physiological Pharmacokinetic model

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

Recommended Books:

PHARMACEUTICS (BIOPHARMACEUTICS & PHARMACOKINETICS)

1. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals.** 1st Ed. Taylor & Francis Publishers; 1990.
2. Augustijns P, Brewster M. **Solvent systems and their selection in pharmaceuticals and biopharmaceuticals.** 1st Ed. Springer; 2007.
3. Curry SH, Whelpton R. **Drug disposition and pharmacokinetics.** Wiley Publishers; 2010.
4. Gibaldi M. **Biopharmaceutics and Clinical Pharmacokinetics.** 4th Ed. Marcel & Dekker Inc; 2008.
5. Gibbson and Skett. **Introduction to Drug Metabolism.** 3rd Ed. Champ & Hall; 2001.
6. Krishna R, Yu L. **Biopharmaceutics applications in drug development.** 2nd Ed. Springer Publishers; 2010.
7. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design.** 1st Ed. Informa HealthCare; 1998.
8. Li AP. **In vitro approaches for evaluation of drug efficacy and toxicity.** 2nd Ed. CRC Press; 2006.
9. Macheras P, Iliadis A. **Modeling in biopharmaceutics, pharmacokinetics, and pharmacodynamics: homogeneous and heterogeneous approaches.** 2nd Ed. Springer Verlag; 2006.
10. Macheras P, Reppas C, Dressman JB. **Biopharmaceutics of Orally Administered Drugs.** 1st Ed. CRC Publishers; 1995.
11. Niazi S. **Text Book of Biopharmaceutics & Clinical Pharmacokinetics.** 2nd Ed. Appleton & Lange; 1985.
12. Notari RE. **Biopharmaceutics and Clinical Pharmacokinetics.** 4th Ed. Marcel & Dekker Inc; 1988.
13. Rouland M, Tozer TN. **Clinical Pharmacokinetics.** 1st Ed. William & Wilkins; 1995.
14. Schoenwald RD. **Pharmacokinetics in drug discovery and Development.** 1st Ed. CRC Press; 2002.
15. Shargel L. **Applied Pharmacokinetics and Biopharmaceutics.** 5th Ed. Appleton & Lange; 2008.
16. Sinko P. **Martin's Physical Pharmacy & Pharmaceutical Sciences: Physical chemical and biopharmaceutical principles in the pharmaceutical sciences.** 5th Ed. Lippincott Williams & Wilkins; 2005.
17. Wilson CG, Washington N. **Physiological Pharmaceutics: Biological Barriers to Drug absorption.** 1st Ed. Ellis Horwood; 1989.
18. Yacobi A, Skelly JP. **Toxicokinetics and New Drug Development.** 1st Ed. Paramount Press; 1989.

PHARMACEUTICS-VIA (Pharmaceutical Quality Management) [THEORY] PHARM 618
Marks:100 Cr. Hr. 03

1. **INTRODUCTION:**

- (a) Basic concepts and introduction of pharmaceutical industry in relevance to quality assurance and quality control departments, testing, quality management system, quality assurance, quality control and quality standards.
- (b) General understanding of good laboratory practices and validation

2. **QUALITY CONTROL OF SOLID DOSAGE FORMS:**

- (a) Physical tests: Hardness, Thickness and Diameter, Friability, Disintegration, Weight Variation.
- (b) Chemical tests: Content uniformity, Assay of active Ingredient and dissolution tests of Powders, Granules, Tablets and Capsules.

3. **QUALITY CONTROL OF SYRUPS, ELIXIRS and DISPERSE SYSTEM:**

Viscosity, its determination and application in the Quality Control of Pharmaceuticals, Weight per ml and Assay of active Ingredient.

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

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

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

PHARMACEUTICS-VIA (Pharmaceutical Quality Management-I) [PRACTICAL] PHARM 619
Marks:50 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. Assay of various spirits, tinctures, extracts, syrups and elixirs, Assay of Ointments and suppositories, Assay of tablets and capsules, Test for alkalinity of glass, Determination of alcohol contents in the Pharmaceutical preparations and Pyrogen test. Sterility test, Determination of Ash contents, Determination of Moisture contents, Determination of total solids, Determination of viscosity of syrups, gels, etc., Determination of emulsion types (Note: A minimum of 10 practicals will be performed).

Recommended Books:

PHARMACEUTICS (PHARMCEUTICAL QUALITY MANAGEMENT)

- 1. Ahuja S, Scypinski S. **Handbook of modern pharmaceutical analysis**. 2nd Ed. Academic Press; 2010.
- 2. Armstrong NA, James KC. **Understanding experimental design and interpretation in Pharmaceutics**. 1st Ed. Taylor & Francis Publishers; 1990.
- 3. Baertschi SW, Alsante KM, Reed RA. **Pharmaceutical stress testing: predicting drug degradation**. 2nd Ed. Informa Healthcare; 2011.

4. Beckett AH, Stennlake JB. **Practical Pharmaceutical Chemistry**. 4th Ed. The Alton Press; 2001.
5. Bismuth G, Neumann S. **Cleaning Validation: A practical Approach**. 1st Ed. CRC Press; 2000.
6. Braithwaite A, Smith FJ. **Chromatographic Methods**. 2nd Ed. Co CBS; 2009.
7. Braun RD. **Introduction to Instrumental Analysis**. 1st Ed. McGraw Hill; 1987.
8. Bryant R. **The pharmaceutical Quality Control Hand Book**. 2nd Ed. Aster Publishing Corporation; 1989.
9. Carstensen JT, Rhodes CT. **Drug Stability: Principles and Practices**. 3rd Ed. Marcel Dekker; 2000.
10. Christian GD. **Analytical Chemistry**. 6th Ed. John Wiley and Sons; 2003.
11. Connors KA. **A Text Book of Pharmaceutical Analysis**. 3rd Ed. John-Wiley and Sons; 1999.
12. Javaid KA. **Pharmaceutical Quality Assurance in Class, Industry and Market**. 1st Ed. Aziz Publishers; 1993.
13. Knevel AM, Digangi FE, Bryn SR. **Quantitative Pharmaceutical Chemistry**. 1st Ed. Waveland Pr Inc; 1982.
14. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design**. 1st Ed. Informa HealthCare; 1998.
15. Lund W. **The Pharmaceutical Codex: Principles and practice of pharmaceuticals**. 16th Ed. Co CBS Publishers; 2009.
16. Mehta DK. **British National Formulary (BNF)**. 54th Ed. Pharmaceutical Press; 2007.
17. Willig SH. **Good Manufacturing Practices for Pharmaceuticals**. 5th Ed. Marcel Dekker Publishing; 2000

SECOND SEMESTER

PHARMACY PRACTICE-IVB (HOSPITAL PHARMACY) PHARM 620 Marks:100	Cr. Hr. 03
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1. **MANUFACTURING BULK AND STERILE:**
2. **THE PHARMACY; CENTRAL STERILE SUPPLY ROOM:**
3. **ASEPTIC DISPENSING:** TPN, I/V Admixtures, Cytotoxic Dispensing, Semi-sterile Dispensing (Eye drops, Ear drops) and Hyperalimentation.
4. **ROLE OF PHARMACIST IN SMALL HOSPITALS, NURSING HOMES etc.**
5. **PURCHASING, DISTRIBUTION AND CONTROL OF HOSPITAL MEDICINES, MEDICAL & SURGICAL SUPPLIES:** Purchasing, Stocking, Stock Control, Inventory Management, Drug Distribution, Relationship between purchasing, Distribution and Clinical Pharmacy Services
6. **NUCLEAR PHARMACY:**
7. **THE PHYSICAL PLANT AND ITS EQUIPMENT:**
8. **INVESTIGATIONAL USE OF DRUGS:**
9. **HEALTH ACCESSORIES:** 10. **SURGICAL SUPPLIES:**
11. **INSPECTION OF WARDS WITH REFERENCE TO DRUG STORAGE AND ADMINISTRATION:**
12. **MANAGEMENT OF ACCIDENT & EMERGENCY PHARMACY (A & E):**

Recommended Books:

PHARMACY PRACTICE (HOSPITAL PHARMACY)

1. Bukhari NI. **Hospital Pharmacy**. 1st Ed. Aziz Book Depot; 2000.
2. Hassan W. **Hospital Pharmacy**. 5th Ed. Lee & Febiger; 1986.
3. Stephen M. **Hospital Pharmacy**. 2nd Ed. Pharmaceutical Press; 2001.

PHARMACY PRACTICE-VB (CLINICAL PHARMACY) PHARM 622	Marks:100	[THEORY] Cr.Hr.03
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1. **PHARMACOTHERAPY PLAN:**
 - a. **Developing, Implementing and Monitoring Drug Therapy Plans:**
 - Pharmacist work up of drug therapy (PWDT)
 - Documentation of Pharmacotherapy Plan
 - o SOAP note
 - o CORE Pharmacotherapy Plan
 - o PRIME Pharmacotherapy problems
 - o FARM note
 - Implementation of Drug Therapy Plan
 - Monitoring of Pharmacotherapeutic plan

- Pharmaceutical care plan as ongoing process
- Importance of drug therapy plan in today's pharmacy practice. b. Pharmacotherapy Decision-Making:
- Pursue the role of drug therapy practitioner over that of drug therapy advisor.
- 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.

3. **DRUG INDUCED DISEASES:**

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

5. **ON LINE PHARMACEUTICAL CARE SERVICES AND GLOBALIZATION:**

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

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

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

PHARMACY PRACTICE-VB (CLINICAL PHARMACY)	[PRACTICAL]
PHARM 623	Cr.Hr.01
Marks:50	

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

Recommended Books:

PHARMACY PRACTICE (CLINICAL PHARMACY)

1. DiPiro JT. **Encyclopedia of Clinical Pharmacy**. 1st Ed. Informa Healthcare; 2002.
2. DiPiro JT. **Pharmacotherapy, A Pathophysiologic Approach**. McGraw Hill Companies, South Carolina; 2008.
3. Gennaro AR. **Remington: The science and practice of pharmacy**. 21st Ed. Lippincott Williams & Wilkins; 2011.
4. Gourley H. **Clinical Pharmacy & Therapeutics**. 4th Ed. William & Willkins; 1992.
5. Greene RJ, Harris ND. **Pathology and therapeutics for pharmacists**. Pharmaceutical Press; 2008.
6. Hansen K, Parthasarathi G. **Text Book of Clinical Pharmacy**. 2nd Ed. Orient Blackswan; 2008.
7. Hansten P, Horn J. **Drug interactions Analysis and Management**. 5th Ed. Lippincott Williams & Wilkins; 2010.
8. Koda-Kimble MA, Young LY, Kradian WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs**. Lippincott Williams & Wilkins Baltimore; 2005.
9. Paul G. **A Behavioral Approach to Pharmacy Practice**. 1st Ed. Black Well; 2000.
10. Rantucci MJ. **Pharmacist Talking with Patients: A Guide to Patient Counseling**. 2nd Ed. Lippincott Williams & Wilkins; 2006.
11. Ritschel WA, Kearns GL. **Handbook of Basic Pharmacokinetics: Including Clinical applications**. 7th Ed. American Pharmacists Association; 2009.
12. Robinson M, Cook S. **Clinical Trials: Risk Management**. 3rd Ed. Churchill Livingstone; 2009.
13. Rosenbaun D. **Clinical Research Coordinator Hand Book**. 4th Ed. Sarrison, Inc; 2001.
14. Smith GDG, Aronson JK. **Oxford Text Book of Clinical Pharmacology and Drug Therapy**. 3rd Ed. Oxford University Press; 2002.
15. Sweetman S. **Martindale: The complete drug reference**. 37th Ed. Pharmaceutical Press. 2011.
16. Taylor K, Harding G. **Pharmacy Practice**. 1st Ed. CRC Press; 2001.
17. Unschuld PU. **Medicine in China: a history of ideas**. 2nd Ed. Univ of California Press; 2010.
18. Walker R. **Clinical Pharmacy & Therapeutics**. 4th Ed. Churchill Livingstone; 2003.
19. Winfield AJ, Rees J, Smith I. **Pharmaceutical practice**. 4th Ed. Churchill Livingstone; 2009.
20. Winter ME. **Basic Clinical Pharmacokinetics**. 5th Ed. Lippincott Williams & Wilkins; 2009.
21. Zinc G. **Remington: The Science and Practice of Pharmacy**. Philadelphia College of Pharmacy and Science: New York 1157; 2005.

PHARMACEUTICS-IVB (INDUSTRIAL PHARMACY) 624	Marks:100	[THEORY] PHARM Cr. Hr. 03
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1. **EMULSIONS:** Mechanical Equipments, Specific formulation consideration and Emulsion stability.
2. **SUSPENSIONS:** Formulation of suspensions, Equipment used in preparation and test methods for pharmaceutical suspensions.
3. **SEMISOLIDS:** Equipment used for Ointments, Pastes, Gels and Jellies. Packaging of ointments.
4. **EQUIPMENTS USED FOR:** Patches, Sprays, Implants, Sutures, Plasters and Sachet packing
5. **STERILE PRODUCTS:** Sterile area and its Classification, Ophthalmic ointments, Preparation of parenterals (Building, Equipment), Complete Sterility (Aseptic area), air control, (Laminar flow etc.), air locks, Environmental monitoring methods, Sterilization, Filling/Packaging (Plastic and glass containers), Added substances (Preservatives, anti-oxidants, solubilizer, suspending agents, buffers, stabilizers etc.), Inprocess Quality Control of Parenterals (Sterility, leakage, pyrogens, clarity etc.).
6. **PACKING & PACKAGING:** Influence of Packaging materials, Stability, Packaging Lines, Packaging Area, Packaging Equipment.
7. **SAFETY METHODS IN PHARMACEUTICAL INDUSTRY:**
 - (a) Mechanical, chemical and fire hazards problems.
 - (b) Inflammable gases and dust

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

PHARMACEUTICS-IVB (INDUSTRIAL PHARMACY) 624	Marks:50	[PRACTICAL] PHARM Cr. Hr. 01
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NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g.

1. Manufacture of Tablets by Wet Granulation Method, by Slugging and by Direct Compression.
 2. Coating of Tablets (Sugar Coating, Film coating and Enteric Coating).
 3. Clarification of liquids by various processes.
 4. Size Reduction. Homogenization.
 5. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables. Capsule filling by semi automatic machines.
 6. Manufacture of sustained action drugs.
 7. Tablets Tests like Disintegration. Dissolution. Friability. Hardness and thickness tests.
 8. Determination of weight variation in tablets. Density of powder. Particle size analysis
- (Note: A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACEUTICS (INDUSTRIAL PHARMACY)

1. Allen LV, Popovich NG. **Ansel's pharmaceutical dosage forms and drug delivery systems.** 8th Ed. Lippincott Williams & Wilkins New York; 2005.
2. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals.** 1st Ed. Taylor & Francis Publishers; 1990.
3. Osol A. **Remington's Pharmaceutical Sciences.** 21st Ed. Mack Publishing Company; 2005.
4. Aulton ME. **Aulton's pharmaceuticals: the design and manufacture of medicines.** 3rd Ed. Churchill Livingstone; 2007.
5. Cooper JW, Gunn C, Carter SJ. **Cooper and Gunn's Tutorial Pharmacy.** 6th Ed. CBS Publishers & Distributors; 2004.
6. Davis H. **Bentley's Text Book of Pharmaceutics.** 2nd Ed. Tindall and Cox Publishers; 1961.
7. Dukes MNG. **The Law and Ethics of the Pharmaceutical Industry.** 1st Ed. Elsevier Science; 2005.
8. Gambardella A. **Science and innovation: The US pharmaceutical industry during the 1980.** 1st Ed. Cambridge Univ Press; 2008.
9. Gennaro AR. **Remington: The Science and Practice of Pharmacy.** 21st Ed. Lippincott Williams & Wilkins; 2011.
10. Ghosh TK, Jasti BR. **Theory and practice of contemporary pharmaceuticals.** 1st Ed. CRC Press; 2005.
11. Lachman L, Lieberman HA, Kanig JL. **Theory and Practice of Industrial Pharmacy.** 3rd Ed. Verghese Publishing House; 2009.
12. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design.** 1st Ed. Informa HealthCare; 1998.
13. Martindale W, Westcoot W. **Martindale's Extra Pharmacopoeia.** 1st Ed. Pharmaceutical Press; 2008.
14. Sharp J. **Good Pharmaceutical Manufacturing Practice.** 6th Ed. Rational and Compliance; 2009.
15. Sinko PJ, Martin AN. **Martin's physical pharmacy and pharmaceutical sciences: physical chemical and biopharmaceutical principles in the pharmaceutical sciences.** 5th Ed. Lippincott Williams & Wilkins; 2006.
16. Watt PR. **Tablet Machine Instrumentation in Pharmaceutics: principles and practice.** 2nd Ed. Ellis Horwood Ltd; 1988.
17. Winfield AJ, Richards RME. **Pharmaceutical practice.** 3rd Ed. Elsevier Health Sciences; 2004.

PHARMACEUTICS-VB (Biopharmaceutics & Pharmacokinetics) [THEORY]
PHARM 626 **Marks:100** **Cr. Hr. 03**

- ELIMINATION OF DRUGS:**
 - Hepatic Elimination:** Percent of Drug Metabolized, Drug Biotransformation reactions, (Phase-I reactions and phase-II reactions), First pass effect, Hepatic clearance of protein bound drugs and Biliary excretion of drugs.
 - Renal Excretion of Drugs:** Renal clearance, Tubular Secretion and Tubular Reabsorption.
 - Elimination of Drugs through other organs:** Pulmonary excretion, salivary excretion, Mammary excretion, Skin excretion and Genital excretion.
- PROTEIN BINDING:** Introduction, types, kinetics, determination and clinical significance of drug-protein binding.
- PHARMACOKINETICS VARIATIONS IN DISEASE STATES:** Determination of pharmacokinetics variations in renal and hepatic diseases, general approaches for dose adjustment in renal disease and hepatic diseases.
- PHARMACOKINETICS OF INTRAVENOUS INFUSIONS:**
- BIOPHARMACEUTICAL ASPECTS IN DEVELOPING A DOSAGE FORM:** Drug considerations, drug product considerations, patient considerations, manufacturing considerations, pharmacodynamic considerations pharmacokinetic considerations.
- BIOAVAILABILITY AND BIOEQUIVALENCE:**
 - Introduction.
 - Bioavailability types, parameters, significance and study protocol. c. Methods of Assessment of Bioavailability.
 - Bioequivalence study designs, components and application, report format.
- IN-VITRO-IN-VIVO CORRELATION (IVIVC):** Introduction, levels and determination of in-vitro/in-vivo correlation.

PHARMACEUTICS-VB (Biopharmaceutics & Pharmacokinetics) [PRACTICAL] PHARM 627
Marks:50 **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.

- Blood Sampling Techniques (In laboratory animals like dog, rabbits, mice etc. in human beings),
- In-vitro dissolution studies,
- Optional dose determination,
- Measurement of rate of Bioavailability,
- Determination of relative and absolute bioavailability.
- Plasma level-time curve (Determination of Pharmacokinetic parameters). Determination of plasma protein binding.
- Urinary sampling techniques in laboratory animals.
- Renal excretion of drugs or drug disposition in animals and humans.

Recommended Books:

PHARMACEUTICS (BIOPHARMACEUTICS & PHARMACOKINETICS)

1. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals**. 1st Ed. Taylor & Francis Publishers; 1990.
2. Augustijns P, Brewster M. **Solvent systems and their selection in pharmaceuticals and biopharmaceuticals**. 1st Ed. Springer; 2007.
3. Curry SH, Whelpton R. **Drug disposition and pharmacokinetics**. Wiley Publishers; 2010.
4. Gibaldi M. **Biopharmaceutics and Clinical Pharmacokinetics**. 4th Ed. Marcel & Dekker Inc; 2008.
5. Gibbson and Skett. **Introduction to Drug Metabolism**. 3rd Ed. Champ & Hall; 2001.
6. Krishna R, Yu L. **Biopharmaceutics applications in drug development**. 2nd Ed. Springer Publishers; 2010.
7. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design**. 1st Ed. Informa HealthCare; 1998.
8. Li AP. **In vitro approaches for evaluation of drug efficacy and toxicity**. 2nd Ed. CRC Press; 2006.
9. Macheras P, Iliadis A. **Modeling in biopharmaceutics, pharmacokinetics, and pharmacodynamics: homogeneous and heterogeneous approaches**. 2nd Ed. Springer Verlag; 2006.
10. Macheras P, Reppas C, Dressman JB. **Biopharmaceutics of Orally Administered Drugs**. 1st Ed. CRC Publishers; 1995.
11. Niazi S. **Text Book of Biopharmaceutics & Clinical Pharmacokinetics**. 2nd Ed. Appleton & Lange; 1985.
12. Notari RE. **Biopharmaceutics and Clinical Pharmacokinetics**. 4th Ed. Marcel & Dekker Inc; 1988.
13. Rouland M, Tozer TN. **Clinical Pharmacokinetics**. 1st Ed. William & Wilkins; 1995.
14. Schoenwald RD. **Pharmacokinetics in drug discovery and Development**. 1st Ed. CRC Press; 2002.
15. Shargel L. **Applied Pharmacokinetics and Biopharmaceutics**. 5th Ed. Appleton & Lange; 2008.
16. Sinko P. **Martin's Physical Pharmacy & Pharmaceutical Sciences: Physical chemical and biopharmaceutical principles in the pharmaceutical sciences**. 5th Ed. Lippincott Williams & Wilkins; 2005.
17. Wilson CG, Washington N. **Physiological Pharmaceutics: Biological Barriers to Drug absorption**. 1st Ed. Ellis Horwood; 1989.
18. Yacobi A, Skelly JP. **Toxicokinetics and New Drug Development**. 1st Ed. Paramount Press; 1989.

1. **BIOLOGICAL ASSAYS:** Biological methods, Standard preparations and units of activity, Bioassay of antibiotics, Bioassay of insulin injection, Assay of prepared digitalis and Assay of Vitamin D.
2. **ALCOHOL DETERMINATION:** Alcoholometric methods, Problem during distillation of alcohol, Method for liquids containing less than 30% or more than 30% alcohol and special treatment before distillation.
3. **ALKALOIDAL DRUG ASSAY:** Weighing for assay, Extraction of drugs, Maceration, Percolation, Continuous extraction, Purification of Alkaloids and determination of alkaloids.
4. **QUALITY ASSURANCE OF VACCINES:** Introduction, Quality measures for stability of vaccines, potency testing, and post market surveillance of vaccines.
5. **MISCELLANEOUS DETERMINATIONS AND TESTS:** Determination of weight/ml, Water/Moisture content, Loss on Drying, Evaluation of Ointments, Ash contents and Alkalinity of Glass.
6. **STATISTICAL INTERPRETATION OF QUALITY CONTROL CHARTS DURING MANUFACTURING PROCESSES:**

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

Determination of alcohol contents in the Pharmaceutical preparations Pyrogen test.

Sterility test,

Determination of Ash contents, Determination of Moisture contents, Determination of total solids,

Determination of viscosity of syrups, gels etc.

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

Recommended Books:

PHARMACEUTICS (PHARMACEUTICAL QUALITY MANAGEMENT)

1. Ahuja S, Scypinski S. **Handbook of modern pharmaceutical analysis.** 2nd Ed. Academic Press; 2010.
2. Armstrong NA, James KC. **Understanding experimental design and interpretation in Pharmaceutics.** 1st Ed. Taylor & Francis Publishers; 1990.
3. Baertschi SW, Alsante KM, Reed RA. **Pharmaceutical stress testing: predicting drug degradation.** 2nd Ed. Informa Healthcare; 2011.
4. Beckett AH, Stenlake JB. **Practical Pharmaceutical Chemistry.** 4th Ed. The Alton Press; 2001.

5. Bismuth G, Neumann S. **Cleaning Validation: A practical Approach**. 1st Ed. CRC Press; 2000.
6. Braithwaite A, Smith FJ. **Chromatographic Methods**. 2nd Ed. Co CBS; 2009. 7. Braun RD. **Introduction to Instrumental Analysis**. 1st Ed. McGraw Hill; 1987.
8. Bryant R. **The pharmaceutical Quality Control Hand Book**. 2nd Ed. Aster Publishing Corporation; 1989.
9. Carstensen JT, Rhodes CT. **Drug Stability: Principles and Practices**. 3rd Ed. Marcel Dekker; 2000.
10. Christian GD. **Analytical Chemistry**. 6th Ed. John Wiley and Sons; 2003.
11. Connors KA. **A Text Book of Pharmaceutical Analysis**. 3rd Ed. John-Wiley and Sons; 1999.
12. Javaid KA. **Pharmaceutical Quality Assurance in Class, Industry and Market**. 1st Ed. Aziz Publishers; 1993.
13. Knevel AM, Digangi FE, Bryn SR. **Quantitative Pharmaceutical Chemistry**. 1st Ed. Waveland Pr Inc; 1982.
14. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical Experimental Design**. 1st Ed. Informa HealthCare; 1998.
15. Lund W. **The Pharmaceutical Codex: Principles and practice of pharmaceuticals**. 16th Ed. Co CBS Publishers; 2009.
16. Mehta DK. **British National Formulary (BNF)**. 54th Ed. Pharmaceutical Press; 2007.
17. Willig SH. **Good Manufacturing Practices for Pharmaceuticals**. 5th Ed. Marcel Dekker Publishing; 2000.

FINAL PROFESSIONAL

FIRST SEMESTER

PHARMACEUTICS-VIIA (Pharmaceutical Technology)

[THEORY]

PHARM 710

Marks: 100

Cr.Hr. 03

1. **PRINCIPLES OF PHARMACEUTICAL FORMULATION AND DOSAGE FORM DESIGN:** Need for dosage form; Preformulation Studies; Product Formulation.
2. **ADVANCED GRANULATION TECHNOLOGY (DESIGN & PRACTICE):** Spray Drying Granulation Technology; Roller Compaction Technology; Extrusion/Spheronization as a Granulation Technique; Single Pot Processing. **Granulation Technology:** Rapid Release Granulation Technique; Particle Coating by Centrifugation Granulation Technology.
3. **POLYMERS USED IN DRUG DELIVERY SYSTEMS:**
4. **NOVEL DRUG DELIVERY SYSTEM (DDS):** Sustained/ Controlled Release Drug Delivery System
 - i) Microencapsulation technique
 - Coacervation
 - Solvent evaporation
 - Interfacial polymerization Spray drying
 - ii) Developmental aspects of Matrix and Reservoir Systems

PHARMACEUTICS-VIIA (Pharmaceutical Technology)

[THEORY]

PHARM 711

Marks: 50

Cr.Hr. 03

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

1. Various techniques to develop the formulation,
2. Granulation technology,
3. Study of drug delivery systems,
4. In-vitro Quality Control of various dosage forms.
5. Particle size analysis using various methods,
6. Stability studies of Pharmaceuticals.
7. Preparation and Coating of particles.

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

Recommended Books:

PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY)

1. Allen LV, Popovich NG, Ansel HC. **Ansel's pharmaceutical dosage forms and drug delivery systems**. 9th Ed. Lippincott Williams & Wilkins; 2010.
2. Hellery AM. **Drug delivery and targeting**. 13th Ed. Taylor & Francis; 2001.
3. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals**. 1st Ed. Taylor & Francis Publishers; 1990.
4. Rahman AU, Iqbal CM. **Bioassay techniques for drug development**. 1st Ed. Informa Healthcare; 2001.
5. Aulton ME. **Pharmaceutics: Science of Dosage Forms Design**. 2nd Ed. Churchill Livingstone; 2001.
6. Banker GS, Rhodes C. **Modern Pharmaceutics**. 4th Ed. Informa Healthcare; 2002.
7. Jain NK. **Controlled and Novel Drug Delivery**. 2nd Ed. CBS Publishers & Distributors; 2008.
8. Bontempo JA. **Development of Biopharmaceutical Parenteral Dosage Forms**. 1st Ed. Informa Healthcare; 1997.
9. Joseph R. **Robinson Controlled Drug Delivery**. 2nd Ed. Marcel & Dekker Inc; 1992.
10. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical experimental design**. 1st Ed. Informa HealthCare; 1998.
11. Lund W. **The pharmaceutical Codex: principles and practice of pharmaceuticals**. 16th Ed. Co CBS Publishers; 2009.
12. Mehta DK. **British National Formulary (BNF)**. 54th Ed. Pharmaceutical Press; 2007.
13. Rathbone MJ, Hadgraft J, Roberts MS, Lane ME. **Modified Release Drug Delivery Technology**. 2nd Ed. Informa Health Care; 2008.
14. Ramabhadran TV. **Pharmaceutical design and development: A molecular Biology Approach**. 1st Ed. Taylor & Francis; 1994.

PHARMACY PRACTICE-VIA (Advanced Clinical Pharmacy)	[THEORY] PHARM 712
Marks: 100	Cr. Hr. 03

1. **RATIONAL USE OF DRUGS:** Rational Prescribing, Rational Dispensing, Problems of Irrational Drug Use, Learning about drug use problem, Sampling to study drug use, Indicators of drug use.
2. **INTRODUCTION TO ESSENTIAL DRUGS:** Criteria for selection, Usage and Advantages. Development of EDL.
3. **DISEASE MANAGEMENT:**
 - Unit V: Central nervous system unit (Stroke, epilepsy, Psychosis)

- Unit VI: Infectious diseases (Meningitis, tuberculosis, dermatological infections, Rabies, Urinary track infection, Malaria fever, typhoid fever, fungal infections of skin, Dengue Fever, Common Cold, Pharyngitis & Tonsillitis, Conjunctivitis)
- Unit VII: Endocrinology Unit (Diabetes Mellitus, Hyper/Hypo thyroidism, pituitary gland non-malignant disorders)

4. **DRUG UTILIZATION EVALUATION & DRUG UTILIZATION REVIEW (DUE/DUR):** Development of protocol of use of few very low therapeutic index drug groups like Steroids, Vancomycin and Cimetidine.
5. **CLINICAL PHARMACOKINETICS:** Therapeutic Drug Monitoring of Digoxin, Theophylline, Gentamycin, Lithium, Phenytoin, Carbamazepine, Phenobarbitone, Valproic Acid, Cyclosporins and Vancomycin.

PHARMACY PRACTICE-VIA (Advanced Clinical Pharmacy)	[PRACTICAL]
PHARM 713	Marks:50
	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.
- Students are required to participate in verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects.

Recommended Books:

PHARMACY PRACTICE (CLINICAL PHARMACY)

1. DiPiro JT. **Encyclopedia of Clinical Pharmacy.** 1st Ed. Informa Healthcare; 2002.
2. DiPiro JT. **Pharmacotherapy, A Pathophysiologic Approach.** McGraw Hill Companies, South Carolina; 2008.
3. Gennaro AR. **Remington: The science and practice of pharmacy.** 21st Ed. Lippincott Williams & Wilkins; 2011.
4. Gourley H. **Clinical Pharmacy & Therapeutics.** 4th Ed. William & Wilkins; 1992.
5. Greene RJ, Harris ND. **Pathology and therapeutics for pharmacists.** Pharmaceutical Press; 2008.
6. Hansen K, Parthasarathi G. **Text Book of Clinical Pharmacy.** 2nd Ed. Orient Blackswan; 2008.
7. Hansten P, Horn J. **Drug interactions Analysis and Management.** 5th Ed. Lippincott Williams & Wilkins; 2010.
8. Koda-Kimble MA, Young LY, Kradjan WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs.** Lippincott Williams & Wilkins Baltimore; 2005.
9. Paul G. **A Behavioral Approach to Pharmacy Practice.** 1st Ed. Black Well; 2000.

10. Rantucci MJ. **Pharmacist Talking with Patients: A Guide to Patient Counseling.** 2nd Ed. Lippincott Williams & Wilkins; 2006.
11. RitschelWA, Kearns GL. **Handbook of Basic Pharmacokinetics: Including Clinical applications.** 7th Ed. American Pharmacists Association; 2009.
12. Robinson M, CookS. **Clinical Trials: Risk Management.** 3rd Ed. Churchill Livingstone; 2009.
13. Rosenbaun D. **Clinical Research Coordinator Hand Book.** 4th Ed. Sarrison, Inc; 2001.
14. Smith GDG, Aronson JK. **Oxford Text Book of Clinical Pharmacology and Drug Therapy.** 3rdEd.OxfordUniversity Press; 2002.
15. Sweetman S. **Martindale: The complete drug reference.** 37th Ed. Pharmaceutical Press. 2011.
16. Taylor K, Harding G. **Pharmacy Practice.** 1st Ed. CRC Press; 2001.
17. Unschuld PU. **Medicine in China: a history of ideas.** 2nd Ed. Univ of California Press; 2010.
18. Walker R. **Clinical Pharmacy & Therapeutics.** 4th Ed. Churchill Livingstone; 2003.
19. Winfield AJ, Rees J, SmithI.**Pharmaceutical practice.** 4th Ed. Churchill Livingstone; 2009.
20. Winter ME. **Basic Clinical Pharmacokinetics.** 5th Ed. Lippincott Williams & Wilkins; 2009.
21. Zinc G. **Remington: The Science and Practice of Pharmacy.** PhiladelphiaCollege of Pharmacy and Science: New York 1157; 2005.

PHARMACY PRACTICE-VII (FORENSIC PHARMACY)

PHARM 714

Marks: 100

Cr. Hr. 03

1. **GENERAL INTRODUCTION:**Forensic Pharmacy & Forensic Pharmacist, History of Drug Legislation and Pharmacy Profession in Pakistan, National Health Policy, National Drug Policy, Essential Drugs, Prescription handling at Retail level and Recordkeeping, Drug Control Administration at Federal and Provincial level.
2. **ROLE OF FORENSIC PHARMACIST:** Forensic drug Measurement, Post-mortem redistribution (PMR), Medication errors, prescription forgery, product tampering, Insurance fraud, Use of drugs or alcohol in car accidents or violent actions, Legal and illegal pharmaceutical evidence in criminal investigations, use of abused drugs in the workplace, professional malpractice, quackery and health care fraud.
3. **PHARMACEUTICAL ETHICS:**Patents and Generics, Ethics in Sale, Ethics in Industry, Ethics in Research.
4. **STUDY OF DRUG LAWS:**
 - a. The Drugs Act 1976 and rules framed there under.
 - b. Provincial Drug Rules (Respective Drug Rules will be taught in the relevant province).
 - c. Advertisement rules.
 - d. Other Related rules and Legal aspects.

Recommended Books:

PHARMACY PRACTICE (FORENSIC PHARMACY)

1. Control of Narcotics Substances Act; 1997.
2. Hussain RZ. **The Manual of Drug Laws in Pakistan**. Irfan Law Book House; 2003.
3. Kokate CK, Gokhale SB. **Textbook of Forensic Pharmacy**. 5th Ed. Edward Arnold; 1959.
4. Shop and Establishment Ordinance; 1969.
5. The Factory Law; 1934.
6. The Pharmacy Act; 1967. 7. The Poisons Act; 1919.

PHARMACY PRACTICE-VIIIA (Pharmaceutical Management & Marketing) PHARM 716
Marks: 100 Cr. Hr. 03

1. **MANAGEMENT & MARKETING:**

- a. Nature and Principles of Management
- b. Types and Functions of Managers
- c. Planning: Purpose and types of Planning, Steps in Planning
- d. Organizing
- e. Management Control Systems. Purpose: Steps in the Control Process, Forms of Operations control. Requirements for adequate control, Critical control points and standards
- f. Motivation
- g. Innovation and creativity
- h. Principals of Marketing
- i. Product Management
- j. Marketing Research

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

Recommended Books:

PHARMACY PRACTICE (PHARMACEUTICAL MANAGEMENT & MARKETING)

1. Ahmad M, Bukhari NI. **Pharmaceutical Management and Marketing**. 1stEd.TariqAcademy; 2002.
2. Harry SA. **Principles & Methods of Pharmacy Management**. 3rd Ed. Lea & Febiger; 1986.
3. Herta MA, Herbert HW, Jeans TP. **Effective Business Communication**. 8th Ed. 2009.
4. Lidstone J, MacLennan J. **Marketing planning for the pharmaceutical industry**. 2nd Ed. Gower Pub Co; 1999.
5. Patrick TC, Pedro LJ. **Pharmacy Management** for students and practitioners. 2nd Ed. Mosby Publishers; 1979.

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

- ~~INTRODUCTION TO MEDICINAL CHEMISTRY:~~** Chemical constitution and biological activity: (Receptor, Theory, Structure Activity Relationships (SAR) and Drug Metabolism). Modern concept of rational drug design, prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules.
- DRUG TARGETS AND DRUG DESIGNING:**
 - Introduction and types of drug targets
 - Introduction to molecular modeling and computational chemistry
 - Structure based designing
 - Ligand based designing
 - Various techniques in drug synthesis
- GENERAL PROPERTIES, CHEMISTRY, BIOLOGICAL ACTION, STRUCTURE ACTIVITY RELATIONSHIP AND THE THERAPEUTIC APPLICATIONS OF THE FOLLOWING:**
 - Hormones: Steroidal Hormones (Testosterone, Progesterone, Estrogen, Aldosteron and Cortisol), Proteinous Hormones (Insulin, Glucagon, Oxytocin and Vassopressin).
 - Anti-neoplastic Agents: Tamoxifen, Fluorouracil, Mercapturine, Methotrexate and Vincristine.
 - Sedatives & Hypnotics: Benzodiazepines, Barbiturates, Paraldehyde, Glutethimide, Chloral hydrate, and alcohols.
 - Anaesthetics: Local anaesthetics (Procaine, Lignocaine, Eucaine, Cocaine and Benzocaine), General anaesthetics (Cyclopropane, Halothane, Nitrous oxide, Chloroform, Thiopental Sodium, Ketamine, Methohexital, Thioamylal Sodium, Fantanyl Citrate, Tribromo ethanol).
 - Analgesics and Antipyretics: Paracetamol, Salicylic acid analogues, Quinolines derivatives, Pyrazolone and Pyrazolodiones, N- arylanthranilic acids, Aryl and heteroaryl acetic acid derivatives.

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

- Estimation of functional groups; Carboxylic, Hydroxy, Amino and Nitro groups; Determination of Molecular weights of Organic Compounds.
- Synthesis of Paracetamol, Salicylic Acid, Methyl salicylate, Azobenzene, Benzoic Acid, 5-Hydroxy-1, 3-benzoxazol-2-one, Aspirin, P-nitrosophenol, 3-nitrophthalic acid, o-Chloro-benzoic acid.
- Assay of the Drugs like Sulpha drugs, Aspirin, Paracetamol, Benzyl Penicillin, Inorganic preparations.

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

Recommended Books:

PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY)

1. Burger A. **Medicinal Chemistry**. 6th Ed. Jhon Willey & Sons; 2003.
2. Block GH, Roche EB, Soine TO, Wilson. **Inorganic and Medicinal Pharmaceutical Chemistry**. 2nd Ed. Verghese Publishing House; 1986.
3. Block JH, Beale JM. **Wilson and Gisvold's textbook of organic medicinal and Pharmaceutical Chemistry**. 12th Ed. Lippincott Williams & Wilkins; 2010.
4. Burger A. **Medicinal Chemistry**. 6th Ed. Jhon Willey & Sons; 2003.
5. Foye WO. **Principles of Medicinal Chemistry**. 6th Ed. Verghese Publishing House; 2008.
6. Gennaro AR. **Remington: The science and practice of pharmacy**. 21st Ed. Lippincott Williams & Wilkins; 2011.
7. Tyagi OD, Yadav M. **Textbook of Synthetic Drugs**. 3rd Ed. Anmol Publications; 2004.

SECOND SEMESTER

PHARMACEUTICS-VIIB (Pharmaceutical Technology)	[THEORY]
PHARM 720	Marks: 100
	Cr. Hr. 03

1. **NOVEL GIT DRUG DELIVERY SYSTEM:**
 - a. Oral Osmotic Pumps
 - b. Ion-Exchange Controlled DDS
 - c. pH-Controlled DDS
 - d. Bio/mucoadhesive DDS
 - e. Floating DDS
2. **DRUG CARRIER SYSTEM:**
 - a. Liposomes
 - b. Niosomes
3. **TARGETED DRUG DELIVERY SYSTEM:**
 - a. Active Drug Delivery System
 - b. Passive Drug Delivery System
4. **PHARMACEUTICAL BIOTECHNOLOGY:**
 - a. Introduction to Biotechnology: Genetics/Genomics, Proteomics, Biomolecular target Identification, Pharmacogenomics, Gene therapy and Nucleic acid therapeutics.
 - b. Techniques Used in Pharmaceutical biotechnology: PCR, DNA Sequencing, Affinity Protein Purification.
 - c. Fundamentals of Genetic Engineering and its Application in Medicine.
 - d. Pharmaceutical Recombinant therapeutic Proteins, Growth factors, Therapeutic antibodies, High-throughput screening of putative therapeutic compounds.
 - e. Biotechnological aspects in the product development.
 - f. Principle, Synthesis and Application of Monoclonal Antibodies.
 - g. Immobilized Enzymes and their application in Medicine.

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

1. Various techniques to develop the formulation,
2. Granulation technology,
3. Study of drug delivery systems,
4. Biotechnological aspect of product development.

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

Recommended Books:

PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY)

1. Allen LV, Popovich NG, Ansel HC. **Ansel's pharmaceutical dosage forms and drug delivery systems**. 9th Ed. Lippincott Williams & Wilkins; 2010.
2. Hellery AM. **Drug delivery and targeting**. 13th Ed. Taylor & Francis; 2001.
3. Armstrong NA, James KC. **Understanding experimental design and interpretation in pharmaceuticals**. 1st Ed. Taylor & Francis Publishers; 1990.
4. Rahman AU, Iqbal CM. **Bioassay techniques for drug development**. 1st Ed. Informa Healthcare; 2001.
5. Aulton ME. **Pharmaceutics: Science of Dosage Forms Design**. 2nd Ed. Churchill Livingstone; 2001.
6. Banker GS, Rhodes C. **Modern Pharmaceutics**. 4th Ed. Informa Healthcare; 2002.
7. Jain NK. **Controlled and Novel Drug Delivery**. 2nd Ed. CBS Publishers & Distributors; 2008.
8. Bontempo JA. **Development of Biopharmaceutical Parenteral Dosage Forms**. 1st Ed. Informa Healthcare; 1997.
9. Joseph R. **Robinson Controlled Drug Delivery**. 2nd Ed. Marcel & Dekker Inc; 1992.
10. Lewis GA, Mathieu D, Phan RTL. **Pharmaceutical experimental design**. 1st Ed. Informa HealthCare; 1998.
11. Lund W. **The pharmaceutical Codex: principles and practice of pharmaceuticals**. 16th Ed. Co CBS Publishers; 2009.
12. Mehta DK. **British National Formulary (BNF)**. 54th Ed. Pharmaceutical Press; 2007.
13. Rathbone MJ, Hadgraft J, Roberts MS, Lane ME. **Modified Release Drug Delivery Technology**. 2nd Ed. Informa Health Care; 2008.
14. Ramabhadran TV. **Pharmaceutical design and development: A molecular Biology Approach**. 1st Ed. Taylor & Francis; 1994.

1. **PHARMACEUTICAL CARE, ITS SCOPE, MANAGEMENT AND APPLICATIONS:**
2. **CLINICAL THERAPEUTICS:**
General Strategy: Terminology of Disease. Management and treatment. Drug selection.
3. **DISEASE MANAGEMENT:**
 - Unit VIII : Oncology Unit (Types of tumors, Introduction to Oncological diseases e.g., Prostate cancer, Breast cancer, Lungs cancer)
 - Unit IX: Nephrology Unit (Renal failure, nephrotic syndrome)
 - Unit X: Hematology Unit (Bleeding disorders/coagulopathies/ clotting disorders e.g. thrombocytopenia, hemophilia, Vit. K deficiency, Anemia)
4. **CLINICAL TOXICOLOGY:**
 - a. General information. Role of pharmacist in treatment of poisoning and general management of poisoning & over dosage. Role and status of Poison Control Centre.
 - b. Antidotes and their mechanism of action.
5. **SAFE INTRAVENOUS THERAPY & HAZARDS OF I.V. THERAPY:**
6. **NON-COMPLIANCE:** Definition, introduction and importance, Extent of non-compliance, Methods of assessment, Reasons for non-compliance, Strategies for improving compliance.

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

Recommended Books:

PHARMACY PRACTICE (CLINICAL PHARMACY)

1. DiPiro JT. **Encyclopedia of Clinical Pharmacy**. 1st Ed. Informa Healthcare; 2002.
2. DiPiro JT. **Pharmacotherapy, A Pathophysiologic Approach**. McGraw Hill Companies, South Carolina; 2008.
3. Gennaro AR. **Remington: The science and practice of pharmacy**. 21st Ed. Lippincott Williams & Wilkins; 2011.
4. Gourley H. **Clinical Pharmacy & Therapeutics**. 4th Ed. William & Willkins; 1992.
5. Greene RJ, Harris ND. **Pathology and therapeutics for pharmacists**. Pharmaceutical Press; 2008.
6. Hansen K, Parthasarathi G. **Text Book of Clinical Pharmacy**. 2nd Ed. Orient Blackswan; 2008.
7. Hansten P, Horn J. **Drug interactions Analysis and Management**. 5th Ed. Lippincott Williams & Wilkins; 2010.

8. Koda-Kimble MA, Young LY, Kradjan WA, Guglielmo BJ, Alldredge BK, Corelli RL. **Applied therapeutics: the clinical use of drugs.** Lippincott Williams & Wilkins Baltimore; 2005.
9. Paul G. **A Behavioral Approach to Pharmacy Practice.** 1st Ed. Black Well; 2000.
10. Rantucci MJ. **Pharmacist Talking with Patients: A Guide to Patient Counseling.** 2nd Ed. Lippincott Williams & Wilkins; 2006.
11. RitschelWA, Kearns GL. **Handbook of Basic Pharmacokinetics: Including Clinical applications.** 7th Ed. American Pharmacists Association; 2009.
12. Robinson M, CookS. **Clinical Trials: Risk Management.** 3rd Ed. Churchill Livingstone; 2009.
13. Rosenbaun D. **Clinical Research Coordinator Hand Book.** 4th Ed. Sarrison, Inc; 2001.
14. Smith GDG, Aronson JK. **Oxford Text Book of Clinical Pharmacology and Drug Therapy.** 3rdEd.OxfordUniversity Press; 2002.
15. Sweetman S. **Martindale: The complete drug reference.** 37th Ed. Pharmaceutical Press. 2011.
16. Taylor K, Harding G. **Pharmacy Practice.** 1st Ed. CRC Press; 2001. 17.Unschuld PU. **Medicine in China: a history of ideas.** 2nd Ed. Univ of California Press; 2010.
18. Walker R. **Clinical Pharmacy & Therapeutics.** 4th Ed. Churchill Livingstone; 2003.
19. Winfield AJ, Rees J, SmithI.**Pharmaceutical practice.** 4th Ed. Churchill Livingstone; 2009.
20. Winter ME. **Basic Clinical Pharmacokinetics.** 5th Ed. Lippincott Williams & Wilkins; 2009.
21. Zinc G. **Remington: The Science and Practice of Pharmacy.** Philadelphia College of Pharmacy and Science: New York 1157; 2005

PHARMACY PRACTICE-VIIB (FORENSIC PHARMACY) PHARM 724

Marks: 100

Cr. Hr. 03

1. **THE PHARMACY ACT 1967:**
2. **CONTROL OF NARCOTICS SUBSTANCES ACT 1997:** Laws relating to Narcotic drugs and psychotropic substances.
3. **THE POISONS ACT 1919:**
4. **THE FACTORIES ACT 1934:**
5. **SHOPS AND ESTABLISHMENTS ORDINANCE 1969 WITH RULES:**

Recommended Books:

PHARMACY PRACTICE (FORENSIC PHARMACY)

1. Control of Narcotics Substances Act; 1997.
2. Hussain RZ. **The Manual of Drug Laws in Pakistan.** Irfan Law Book House; 2003.
3. Kokate CK, Gokhale SB. **Textbook of Forensic Pharmacy.** 5th Ed. Edward Arnold; 1959.
4. Shop and Establishment Ordinance; 1969.
5. The Factory Law; 1934.
6. The Pharmacy Act; 1967. 7. The Poisons Act; 1919.

PHARMACY PRACTICE-VIII B (Pharmaceutical Management & Marketing)

PHAM 726

Marks: 100

Cr. Hr. 03

1. MARKETING MANAGEMENT:

- a. Ethical consideration of Pharmaceutical Marketing
- b. Difference between Pharmaceutical Marketing and Consumer Marketing
- c. Major stakeholders within pharmaceutical market environment.
- d. Marketing Research (Process and Methodology)
- e. Market Analysis Techniques 3Cs (Customer analysis, Company analysis, competitors analysis)
- f. Evaluating the marketing performance (audit tools and audit process)
- g. Designing sales force structure, sales force size and sales quota
- h. Marketing channels, Promotion and Advertising and Salesmanship.

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

3. BUSINESS DEVELOPMENT MANAGEMENT: General principles, strategies, short and long term planning and objectives.

4. BUSINESS COMMUNICATION: Importance and benefits of business communication, components of communication, concept and problems of communication, 7C's of communications.

5. STRATEGIES FOR SUCCESSFUL BUSINESS AND GLOBAL MEETINGS: Background information on groups, purpose and kinds of meetings, solving problems in meetings, leadership responsibilities in meetings, participant's responsibilities in meetings.

Recommended Books:

PHARMACY PRACTICE (PHARMACEUTICAL MANAGEMENT & MARKETING)

1. Ahmad M, Bukhari NI. **Pharmaceutical Management and Marketing.** 1stEd.TariqAcademy; 2002.
2. Harry SA. **Principles & Methods of Pharmacy Management.** 3rd Ed. Lea & Febiger; 1986.
3. Herta MA, Herbert HW, Jeans TP. **Effective Business Communication.** 8th Ed. 2009.
4. Lidstone J, MacLennan J. **Marketing planning for the pharmaceutical industry.** 2nd Ed. Gower Pub Co; 1999.
5. Patrick TC, Pedro LJ. **Pharmacy Management** for students and practitioners. 2nd Ed. Mosby Publishers; 1979.

PHARMACEUTICAL CHEMISTRY-IV B (Medicinal Chemistry) [THEORY] PHARM

728

Marks: 100

Cr. Hr. 03

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

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

- a. Sulphonamides: Prontosil, sulphanilamide, Sulphapyridine, sulphadimidine, Sulfamethoxazole, Sulfadiazine and Sulfafurazole.
- b. Antimalarials: 4-Aminoquinolines, 8-Aminoquinolines, 9-Amino acridines, Biguanides, Pyrimidine analogues, Mefloquine and Cinchona alkaloids.
- c. Diuretics: Mercaptopmerin, Meralluride, Thiazides, Spironolactone, Theophylline, Furosemide Acetazolamide, Ethacrynic acid and Triameterene
- d. Antitubercular Drugs: Ethambutol, Isonicotinic acid, Hydrazid, Rifampacin, Thioguanine, Pyrazinamide, cycloserine, Ethunamide, Cytarabine, 5-Flourouracil and Dacarbazine.
- e. Antiviral Drugs: Acyclovir, Tromantadine Hydrochloride and Ribavirin. f. Immunosuppressant Agents: Azathioprine and Cyclosporin.
- g. Antibiotics: Penicillins, Cephalosporins, Streptomycin, Chloramphenicol, Tetracyclines, Kanamycin and Erythromycin.

PHARMACEUTICAL CHEMISTRY-IVB (Medicinal Chemistry)[PRACTICAL] PHARM 729	Marks: 50	Cr. Hr.: 01
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NOTE: Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Estimation of functional groups; Carboxylic, Hydroxy, Amino and Nitro groups; Determination of Molecular weights of Organic Compounds. Synthesis of Paracetamol, Salicylic Acid, Methyl salicylate, Azobenzene, Benzoic Acid, 5-Hydroxy-1, 3-benzoxazol-2-one, Aspirin, P-nitrosophenol, 3-nitrophthalic acid, o-Chloro-benzoic acid. Assay of the Drugs like Sulpha drugs, Aspirin, Paracetamol, Benzyl Penicillin. Inorganic Preparations (Note: A minimum of 10 practicals will be conducted).

Recommended Books:

PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY)

1. Burger A. **Medicinal Chemistry**. 6th Ed. Jhon Willey & Sons; 2003.
2. Block GH, Roche EB, Soine TO, Wilson. **Inorganic and Medicinal Pharmaceutical Chemistry**. 2nd Ed. Verghese Publishing House; 1986.
3. Block JH, Beale JM. **Wilson and Gisvold's textbook of organic medicinal and Pharmaceutical Chemistry**. 12th Ed. Lippincott Williams & Wilkins; 2010.
4. Burger A. **Medicinal Chemistry**. 6th Ed. Jhon Willey & Sons; 2003.
5. Foye WO. **Principles of Medicinal Chemistry**. 6th Ed. Verghese Publising House; 2008.
6. Gennaro AR. **Remington: The science and practice of pharmacy**. 21st Ed. Lippincott Williams & Wilkins; 2011.
7. Tyagi OD, Yadav M. **Textbook of Synthetic Drugs**. 3rd Ed. Anmol Publications; 2004.

NOTE: Upon completion of recognized Pharm.D. degree, a pharmacy graduate is required to undergo residency based training for a period of 1 year in any area; at general or private Hospital, Pharmaceutical Industry, Community Pharmacy, Pharmaceutical Marketing, Research & Development and Public health recognized by the Pharmacy Council of Pakistan. The objective of the residency is to undergo a planned training on aspects of pharmacy practice under the supervision of a registered pharmacist.

RECOMMENDATIONS:

1. The up-dated curriculum of Doctor of Pharmacy program after the approval from Pharmacy Council of Pakistan (PCP) and Higher Education Commission (HEC) shall be binding on every Pharmacy Institution/ University (Public and Private) to adopt revised curricula.
2. The revised curricula shall be adopted from the 2012 session.
3. Violation in adoption of the approved curriculum shall be liable to penalty under section 17 & 19 of Pharmacy Act, 1967 and rules framed there-under, which may lead to revoking of affiliation/ accreditation by the PCP.
4. No omission and changes are allowed in the said curriculum approved by PCP and HEC, by any institution.
5. Doctor of Pharmacy degree holders will be allowed for direct admission in M.S. /M. Phil leading to PhD program.