CURRICULUM

OF

DOCTOR OF PHARMACY
(PHARM-D)

(Revised 2011)

HIGHER EDUCATION COMMISSION
ISLAMABAD, PAKISTAN

CURRICULUM DIVISION, HEC

Dr. Syed Sohail H. Naqvi	Executive Director
Prof. Dr. Altaf Ali G. Shaikh	Member (Acad)
Mr. Muhammad Javed Khan	Adviser (Academics)
Malik Arshad Mahmood	Director (Curri)
Dr. M. Tahir Ali Shah	Deputy Director (Curri)
Mr. Abdul Fatah Bhatti	Assistant Director (Curri)

Composed by: Mr. Zulfiqar Ali, HEC, Islamabad

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PREFACE

The curriculum of subject is described as a throbbing pulse of a nation. By viewing curriculum one can judge the stage of development and its pace of socio-economic development of a nation. With the advent of new technology, the world has turned into a global village. In view of tremendous research taking place world over new ideas and information pours in like of a stream of fresh water, making it imperative to update the curricula after regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

In exercise of the powers conferred under Section 3, Sub-Section 2 (ii) of Act of Parliament No. X of 1976 titled **"Supervision of Curricula and Textbooks and Maintenance of Standard of Education"** the erstwhile University Grants Commission was designated as competent authority to develop review and revise curricula beyond Class-XII. With the repeal of UGC Act, the same function was assigned to the Higher Education Commission under its Ordinance of 2002 Section 10, Sub-Section 1 (v).

In compliance with the above provisions, the HEC undertakes revamping and refurbishing of curricula after regular intervals in a democratic manner involving universities/DAIs, research and development institutions and local Chamber of Commerce and Industry. The intellectual inputs by expatriate Pakistanis working in universities and R&D institutions of technically advanced countries are also invited to contribute and their views are incorporated where considered appropriate by the National Curriculum Revision Committee (NCRC).

To bring international compatibility to qualifications held from Pakistani universities/DAIs for promotion of students mobility and job seekers around the globe, a Committee comprising of Conveners of the National Curriculum Revision Committee of HEC met in 2009 and developed a unified template for standardized 4-year/8-semester BS degree programmes. This unified template was aimed to inculcate broader base of knowledge in the subjects like English, Sociology, Philosophy, Economics etc. in addition to major discipline of study. The Pharmacy degree course requires to be completed in 5-year/10-semester, and shall require qualifying of 130-140 credit hours of which 77% of the curriculum will constitute discipline specific and remaining 23% will comprise compulsory and general courses.

In line with above, NCRC comprising senior university faculty and experts from various stakeholders and the respective accreditation councils has finalized the curriculum for Doctor of Pharmacy (Pharm-D) in 5-year The same is being recommended for adoption by the universities/DAIs channelizing through relevant statutory bodies of the universities.

MUHAMMAD JAVED KHAN
Adviser (Academics)

June, 2011

CURRICULUM DEVELOPMENT

INTRODUCTION:

The National Curriculum Revision Committee (NCRC) final meeting was held on June 6-8, 2011 at HEC Regional Centre, Karachi to finalize the draft Curriculum for Doctor of Pharmacy (Pharm-D) Program reviewed/revised by the committee in its preliminary meeting held from 28th February to 2nd March, 2011 at HEC Regional Centre, Lahore

1.	Prof. Dr. Abdullah Dayo Dean, Faculty of Pharmacy, University of Sindh, Jamshoro.	Convener
2.	Prof. Dr. Gul Majid Khan Dean, Faculty of Pharmacy, Gomal University, D.I. Khan.	Secretary
3.	Prof. Dr. Javeid Iqbal Dean/ Member Core Committee, PCP, Department of Pharmacy, Hamdard University, Karachi	Member
4.	Prof. Dr. Mahmood Ahmad Dean, Faculty of Pharmacy, Islamia University, Bahawalpur	Member
5.	Prof. Dr. Ghazala H. Rizwani, Dean Faculty of Pharmacy, University of Karachi, Karachi.	Member
6.	Mr. Ayaz Ali Khan Specialist Medical Product and e Committee trengthening Park Road, ad	Member
	  urch, haceutical ctor G-7/4,	Member
	uri,	Member

Abbreviations Used:

NCRC. National Curriculum Revision Committee
VCC. Vice-Chancellor's Committee
EXP. Experts
COL. Colleges
UNI. Universities
PREP Preparation
REC. Recommendations
LI Learning Innovation
R&D Research & Development Organization
HEC Higher Education Commission

	Country Advisor Medicine WHO Member Core Committee PCP, Health System Strengthening and Policy Unit, HSA, Ministry of Health, Park Road, Chak Shahzad, Islamabad.	
9.	Prof. Dr. Khwaja Zafar Ahmed Dean, Ziauddin College of Pharmacy, Ziauddin University, Karachi.	Member
10.	Dr. Muhammad Iqbal Chairman, Department of Pharmacy, University of Faisalabad, Faisalabad.	Member
11.	Prof. Dr. Kamran Ahmed Chishti Dean, Faculty of Pharmacy, Sarhad University of Science & Information Technology, Peshawar.	Member (Attended preliminary meeting)
12.	Prof. Dr. Syed Saeed-ul-Hassan Principal, University College of Pharmacy, University of the Punjab, Lahore.	Member
13.	Prof. Dr. Hafeez Ikram Head Department of Pharmacy, Lahore College for Women University, Lahore.	Member
14.	Dr. Ali Akbar Sial Dean, Faculty of Pharmacy, Federal Urdu University, Block-9, University Road, Karachi.	Member
15.	Prof. Dr. Fazal Subhan Professor Department of Pharmacy University of Peshawar, Peshawar.	Member
16.	Prof. Dr. Muhammad Jamshaid Dean	Member

	Faculty of Pharmacy, Hajvery University, Lahore	
17.	Dr. Khalid Hussain Janbaz Chairman, Department of Pharmacy, B.Z. University, Multan.	
18.	Mr. Amjad Ali Jawa Managing Director, Wilshire Laboratories (Pvt) Ltd 124/1- Industrial Estate Kot Lakhpat, Lahore.	Member (Attended Preliminary meeting)
19.	Dr. Shahzad Hussain Senior Scientific Officer Drugs Control & Traditional Medicines Division, National Institute of Health, Islamabad.	Member
20.	Mr. Latif Sheikh, Director Pharmacy / Member Core Committee, Agha Khan University Hospital, Karachi.	Member
21.	Mr. Naziruddin Ahsan, Secretary, Pharmacy Council of Pakistan, Taimur Chamber, 10-D, West Blue Area, Islamabad.	Member
22.	Prof. Dr. Khalid Hussain Janbaz Chairman, Department of Pharmacy, B.Z. University, Multan	Member (Attended Preliminary meeting)
23.	Dr. Farid Khan, Consultant Pharmacist, 68/1, Khayaban-e-Mohfiz, DHA Phase –IV, Karachi.	Member (Attended Preliminary meeting)
24.	Syed Umer Jan, Assistant Professor, Department of Pharmacy, University of Baluchistan, Quetta.	Member
25.	Dr. Sajid Bashir, Chairman, Department of Pharmacy, University of Sargodha,	Member

	Sargodha.	
26.	Mr. Jahangir Khan, Assistant Professor, Department of Pharmacy, University of Malakand, Chakdara (Lower Dir)	Member

The meeting started with recitation from the Holy Quran by prof. Dr. Javed Iqbal, Dean, Faculty of Pharmacy, Hamdard University, Karachi. Mr. Muhammad Javed Khan, Advisor (Academics), HEC welcomed the participants on behalf of the Chairman HEC. The Advisor (Acad.) briefed the participants about the procedure of curriculum review and revision and apprised the members of the Committee about the performance and achievements of the HEC Curriculum Division.

Prof. Dr. Abdullah Dayo, Dean, Faculty of Pharmacy, University of Sindh, Jamshoro was elected as Convener and Prof. Dr. Gul Majid Khan, Dean, Faculty of Pharmacy, Gomal University, D.I.Khan (KPK) as the Secretary in order to conduct the meeting and record the proceedings accordingly.

Dr. M. Tahir Ali Shah, Dy. Director Curriculum HEC Islamabad, distributed comments received from local experts from the country and Dr. Tahir Memood Khan, K Expatriate Pakistani Expert, King Faisal University, Saudi Arabia for consideration of the NCRC.

After three days deliberations of the meeting the Final Draft of the curriculum for the Doctor of Pharmacy (Pharm-D) degree program was compiled and finalized along with recommendations.

Dr. M. Tahir Ali Shah, Dy. Director Curriculum HEC Islamabad thanked the Convener, Secretary members of the Committee, Pharmacy Council of Pakistan, World Health Organization (WHO) members of the core committee of PCP for sparing their time and making this noble contribution towards preparation of curriculum for Pharm-D to be followed by all Universities and degree awarding institutions of Pakistan

Aims & Objectives of the Curriculum of Pharm. D. Program

The aims and objectives of Doctor of Pharmacy (Pharm.D) curriculum should be to prepare graduates who will have the capacity, up to date knowledge, strong ethical values, behavior, communication, writing and social skills that will enable them to pursue careers in:

1. Pharmaceutical care in health systems & community environment where appropriate medication usage and patient's safety is paramount.

2. The Pharmaceutical Industry and its quality systems.

3. Academia, research & development.

Aims

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

Objectives

1. To keep in pace with the Advancements in the Modern Sciences
2. To prepare the students to fulfill the Industrial needs and they should be well versed with the basic medical and pharmaceutical sciences in order to prepare a dosage regimen for an individual patient.
3. Community pharmacy practice should be comprehensive.
4. Internship in various disciplines of Pharmacy should be implemented
5. Update the syllabi of the Pharmacy keeping in view the current proposals, requirements and the needs of the profession.
6. To make our graduates more skillful, competitive and knowledgeable both practically and theoretically.
7. To cater the local and international pharmacy needs
8. Uniformity in the curriculum of Pharmacy at National Level.
9. Credit hours should be harmonized i.e. Practical and theory credit hours.
10. To make a health care practitioner who is expert in the use of medicine in all practical fields and are capable of disease state management specially to improve public health at large.
11. Upon graduation, Pharm.D. graduates should have the capacity, knowledge and capability to undertake career in

    a) Enhance patient safety to safe medication usage in community and health care systems
    b) To work in the Pharmaceutical Industry and its quality system
    c) To engage in academics and research i.e. Practice and Academics.
    d) To prepare students as good human beings in serving the community i.e., ethics, communication skills, writing skills, behavior etc.
    e) After graduation, he should become a member of health care team.
    f) To help the stakeholders of pharmacy about the implications of WTO TRIPS.

12. The syllabi should be more practical rather theoretical.
13. To include new things regarding OTC Pharmacy (Patient Pharmacist interaction).
14. To prepare pharmacy graduates for better pharmacy practice in the areas including clinical pharmacy, community pharmacy, hospital pharmacy and industrial pharmacy.
15. To add further in the curriculum clinical oriented areas as per demand of Pharm.D. degree.
16. To update the current syllabi according to the needs of the national and international demand.
17. To develop graduates capable of catering the needs of National and International health organizations or authorities to help adapt the paradigm shift in the health care system.
18. To bring uniformity in the contents of the syllabi in line with International trends/International Universities imparting Pharm.D. education.

19. To produce the graduates to meet the challenges of 21st century of health care problems.

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

1st Professional Pharm. D.

Ist Semester			2nd Semester		
Course No	Subject	Cr.Hr	Course No.	Subject	Cr. Hr
ENG 300	English	2	ENG 301	English (Communication & Writing skills)	4
PHARM 310	(Functional) Pharmaceutics-I (Physical	3 1	PHARM 320	Pharmaceutics-II (Physical Pharmacy-I) [Th.]	3 1
PHARM 311	Pharmacy-1) [Th.] Pharmaceutics-I [Lab.]	3 1	PHARM 321	Pharmaceutics-II [Lab.] Pharmaceutical	3
PHARM 312	Pharmaceutical Chemistry-I	3	PHARM 322	Chemistry-II (Organic-II) [Th.]	1
PHARM 313	(Organic-I) [Th.] Pharmaceutical Chemistry-I [Lab.]	1	PHARM 323	Pharmaceutical Chemistry-II [Lab.] Pharmaceutical Biochemistry-II [Th.]	3 1
PHARM 314	Pharmaceutical Biochemistry-I [Th.]	3 1	PHARM 324	Pharmaceutical Biochemistry-II [Lab.]	3 1
PHARM 315	Pharmaceutical Biochemistry-I [Lab.]	3 1	PHARM 325	Physiology-II [Th.] Physiology-II [Lab.]	
PHARM 316	Physiology-I [Th.]		PHARM 326		
PHARM 317	Physiology-I [Lab.]		PHARM 327		
PHARM 318	Anotomy & Hitology [Th]				
PHARM 319	Anotomy & Hitology [LAB]				
	Total Cr. Hr.	22		Total Cr.Hr.	20

2nd Professional Pharm. D.

Ist Semester			2nd Semester		
Course No	Subject	Cr. Hr	Course No.	Subject	Cr. Hr
IS 402	Islamic Studies	1	PS 403	Pakistan Studies	1
PHARM 410	Pharmaceutics-III (Dosage Form Science-I) [Th.]	3 1	PHARM 420	Pharmaceutics-V (Dosage Form Science-II) [Th.]	3 1
PHARM 411	Pharmaceutics-III [Lab.]	3	PHARM 421	Pharmaceutics-IV [Lab.]	3
PHARM 412	Pharmaceutics-IV (Microbiology& Immunology-I) ([Th.]	1 3	PHARM 422	Pharmaceutics-VI (Microbiology& Immunology-I) ([Th.]	1
PHARM 413	Pharmaceutics-IV [Lab.] Pharmacology and Therapeutics-I [Th.]	1	PHARM 423	Pharmaceutics-VI [Lab.] Pharmacology and Therapeutics-II [Th.]	3 1
PHARM 414	Pharmacology and Therapeutics-I [Lab.]	3 1	PHARM 424	Pharmacology and Therapeutics-II [Lab.]	3 1
PHARM 415	Pharmacognosy-I (Basic) [Th.] Pharmacognosy-I [Lab.]	3	PHARM 425	Pharmacognosy-II (Basic) [Th.] Pharmacognosy-II [Lab.]	3
PHARM 416	Pharmacy Practice-I (Pharmaceutical Mathematics)		PHARM 426	Pharmacy Practice-II (Bio-statistics)	
PHARM 417			PHARM 427		
PHARM 418			PHARM 428		
	Tot. Cr. Hr.	20		Tot. Cr. Hr.	20

3rd Professional Pharm. D.

Ist Semester			2nd Semester		
Course No	Subject	Cr. Hr	Course No.	Subject	Cr. Hr
PHARM 510	Pharmacy Practice-III (Dispensing Pharmacy)[Th.]	3	PHARM 520	Pharmacy Practice-IV (Community, Social & Administrative Pharmacy) [Th.]	3
PHARM 511	Pharmacy Practice-III [Lab.]	1	PHARM 522	Pharmaceutical Chemistry-IV	3
PHARM 512	Pharmaceutical Chemistry-III (Pharmaceutical Analysis-I) [Th]	3	PHARM 523	(Pharmaceutical Analysis-II) [Th]	1
PHARM 513	Pharmaceutical Chemistry-III [Lab]	1	PHARM 524	Pharmaceutical Chemistry-IV [Lab]	3
PHARM 514	Pharmacology and Therapeutics-III [Th.]	3	PHARM 525	Pharmacology and Therapeutics-IV [Th.]	1
PHARM 515	Pharmacology and Therapeutics-III [Lab.]	1	PHARM 526	Pharmacology and Therapeutics-IV [Lab.]	3
PHARM 516	Pharmacognosy-III [Th.]	1	PHARM 527	Pharmacognosy-IV [Th.]	1
PHARM 517	Pharmacognosy-III [Lab.] Pathology [Th]	3	PHARM 528	Pharmacognosy-IV [Lab.]	3
PHARM 518	Pathology [Lab]	1	PHARM 529	Pharmacy Practice-V (Computer and its Applications in Pharmacy) [Th]	1
PHARM 519				Pharmacy Practive-V (Computer and its Applications in Pharmacy) [Lab]	1
	Tot. Cr. Hr.	20		Tot. Cr. Hr.	19

4th Professional Pharm. D.

Ist Semester			2nd Semester		
Course No	Subject	Cr. Hr	Course No.	Subject	Cr. Hr
PHARM 610	Pharmacy Practice-VI (Hospital Pharmacy-I) [Th.]	3 3	PHARM 620	Pharmacy Practice-VIII (Hospital Pharmacy-II) [Th.]	3 3
PHARM 612	Pharmacy Practice-VII (Clinical Pharmacy-I) [Th.]	1 3	PHARM 622	Pharmacy Practice-IX (Clinical Pharmacy-II) [Th.]	1 3
PHARM 613	Pharmacy Practice-VII [Lab.]	1	PHARM 623	Pharmacy Practice-IX [Lab.]	1
PHARM 614	Pharmaceutics-VII (Industrial Pharmacy-I) [Th.]	3 1	PHARM 624	Pharmaceutics-X (Industrial Pharmacy-II) [Th.]	3 1
PHARM 615	Pharmaceutics-VII [Lab.]	3	PHARM 625	Pharmaceutics-X [Lab.]	3
PHARM 616	Pharmaceutics-VIII (Bio-pharmaceutics-I) [Th.]	1	PHARM 626	Pharmaceutics-XI (Bio-pharmaceutics-II) [Th.]	1
PHARM 617	Pharmaceutics-VIII [Lab.]		PHARM 627	Pharmaceutics-XI [Lab.]	
PHARM 618	Pharmaceutics-IX (Pharm. Quality Management-I) [Th.]		PHARM 628	Pharmaceutics-XII (Pharm. Quality Management-II) [Th.]	
PHARM 619	Pharmaceutics-IX [Lab.]		PHARM 629	Pharmaceutics-XII [Lab.]	
	Tot. Cr. Hr.	19		Tot. Cr. Hr.	19

5th (Final) Professional Pharm. D.

Ist Semester			2nd Semester		
Course No	Subject	Cr. Hr	Course No.	Subject	Cr. Hr
PHARM 710	Pharmaceutics-XIII (Pharma- ceutical Technology-I) [Th]	3 1	PHARM 720	Pharmaceutics- XIV (Pharmaceutical Technology-II) [Th]	3 1
PHARM 711	Pharmaceutics-XIII [Lab]	3	PHARM 721	Pharmaceutics- XIV [La	3
PHARM 712	Pharmacy Practice-X (Clinical Pharmacy-III) [Th]	1	PHARM 722	Pharmacy Practice-XIII (Clinical Pharmacy-IV) [Th]	1 3
PHARM 713	Pharmacy Practice-X [Lab]	3	PHARM 723	Pharmacy Practice-XIII [Pharmacy Practice-XIV (Forensic Pharmacy-II) [T	3
PHARM 714	Pharmacy Practice-XI (Forensic Pharmacy-I) [Th.]	3	PHARM 724	Pharmacy Practice- V (Pharmaceutical Manage & Marketing-II	3
PHARM 716	Pharmacy Practice-XII Pharmaceutical Management & Marketing-I	3 1	PHARM 726	Pharmaceutical Chemist (Medicinal-II)[Th]	1
PHARM 718	Pharmaceutical Chemistry-\ (Medicinal-I)[Th]		PHARM 728	Pharmaceutical Chemist [Lab]	
PHARM 719	Pharmaceutical Chemistry-\ [Lab]		PHARM 729		
	Tot. Cr. Hr.	18		Tot. Cr. Hr.	18

Note:- *Each Theory Course carries 100 marks and each Laboratory Course carries 50 marks except Islamic Studies and Pakistan Studies which carry 60 and 40 marks, respectively.*

PHARM. D.	1st SEMESTER CR. HR.	2nd SEMESTER CR. HR.	TOTAL CR. HR.
1st Prof.	22	20	42
2nd Prof.	20	20	40
3rd Prof.	20	19	39
4th Prof.	19	19	38
Final Prof.	18	18	36
Total Credit Hours:-	99	96	195

DETAILS OF COURSES (SEMESTER SYSTEM)

FIRST PROFESSIONAL

FIRST SEMESTER

ENG 300 English-I (Functional English)

Cr. Hr.: 02 Marks: 100

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: To be improved by showing documentaries/films carefully selected by subject teachers

Translation skills: Urdu to English

Paragraph writing: Topics to be chosen at the discretion of the teacher Presentation skills: Introduction

Note: *Extensive reading is required for vocabulary building*

Recommended books:

1. Functional English

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

b) Writing

Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

c) Reading/Comprehension

Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

d) Speaking

PHARM 310 **PHARMACEUTICS-I (Physical Pharmacy-I) [Th.]**

Cr. Hr.: 03 Marks: 100

1. **PHARMACY ORIENTATION:**
   Introduction and orientation to the Professional 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: Solubility, factors affecting solubility, surfactants, their properties and types. Micelles, their formulation and types.

   c. Ionization, pH, pH indicators, pka, buffers, buffer's equation, Isotonic solutions and their applications in pharmacy.

   d. Hydrolysis, types and protection of drugs against hydrolysis.

   e. Micromeritics: Particle size and shapes, distribution of particles methods of determination of particle size and importance of particle size in Pharmacy.

4. **DISPERSIONS:**

   a. Colloids: Types, methods of preparation, properties (optional, kinetic, electrical) Dialysis and artificial kidney, stability of colloids, protection and sensitization phenomenon and application of colloids in Pharmacy.
   b. Emulsions: Types, theories of emulsification, Emulsifying agents their classification and stability of emulsion.
   c. Suspensions: Type, Methods of Preparation, Properties, Suspending agents, their classification and stability.
   d. Adsorption: Techniques and processes of adsorption in detail.

PHARM 311 PHARMACEUTICS-I (Physical Pharmacy-I) [Lab.]

Cr. Hr.: 01 Marks: 50

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.

1. Determination of Emulsion systems.
2. Determination of particle size.
3. Density, Specific Volume, Weights and Volumes of Liquids.
4. Preparation of Buffer solutions and isotonic solution.
5. Determination of %age composition of solutions by specific gravity method.

Recommended Books:

1. Martin, Physical Pharmacy, B I Waverly PVT, Delhi, 5th Ed., 2005.
2. Cooper and Gunns Tutorial Pharmacy, 6th Ed, CBS Publishers & Distributors, New Delhi, 2005.
3. Bentley's Pharmaceutics, All India Traveler Book Seller, New Delhi, 1996.
4. Martin P, Bustamante P and Chun, Physical & Chemical Principles of Pharmaceutical Science, AHC, 6th Ed., (1999), New York.
5. Martin AMN, Banker G S and Chun AHC Advances in Pharmaceutical Sciences. Vol 7, Academic Press, London, 1995.
6. Mill C C Casson,N. Rheology of disperse systems. Pergamon Press, New York, 1975.
7. Rienger M and Scott-Blair. G W Rheology. Academic Press, London, 1990.
8. Barry B W Advances in Pharmaceutical Sciences, Academic Press, London, 1990.
9. Sherman P Emulsion Science, Academic Press, London, 1972. 1 0.Martin A, Swarbrick J and Cammatra A
10. Physical Pharmacy, 3rd Ed., Lee & Febiger, Philadelphia. 1983.
11. Attwood D and Flocence A T Surfactant Systems.Chapman and Hall Ltd, London, 1982.

PHARM 312 PHARMACEUTICAL CHEMISTRY-I (ORGANIC-I) [Th.]

Cr. Hr.: 03 Marks: 100

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

1. BASIC CONCEPTS: Chemical Bonding and concept of Hybridization, Conjugation, Resonance (Mesomerism), Hyperconjugation, Aromaticity, Inductive Effect, Electromeric, Effect, Hydrogen bonding, Steric Effect, Effect

of structure on reactivity of compounds. Tautornerism of Carbonyl Compounds Nomericlature of Organic Compounds.

2. STEREO CHEMISTRY\CONFORMATIONAL ANALYSIS: Tereoisomerism, optical isomerism; Molecules with more than one chiral center Geometrical isomerism, Resolution of racemic mixture. Conformational analysis

3. GENERAL METHOD OF PREPARATIONS 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
5. Orientation in Electrophilic

PHARM 313 PHARMACEUTICAL CHEMISTRY-I (ORGANIC-I) [Lab.]

Cr. Hr.: 01 Marks: 50

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

Recommended Books

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

Ed., 2007.
11. L.G. Wade, Organic Chemistry, Prentice Hall, New York, U.S.A., 7th Ed., 2010.

PHARM 314 PHARMACEUTICAL BIO-CHEMISTRY-I [Th.]

Cr. Hr.: 03 Marks: 100

1. GENERAL INTRODUCTION AND BASIC BIOCHEMICAL PRINCIPLES:
   Role of pharmaceutical Biochemistry in the health Profession. Nature of Biochemical reactions.

2. BASIC CHEMISTRY OF BIOMOLECULES: (Nature, Classification etc.)

   a) Carbohydrates: Chemistry, Classification, Reactions of Carbohydrates, Optical activity, Biological and pharmaceutical importance of carbohydrates.
   b) Lipids: Chemistry of Fatty acids and Lipids, Classification (Saponifiable and non- saponifiable lipids, Simple, Complex and derived lipids), Reactions of Fatty acids and other Lipids, Essential fatty acids, Biological and pharmaceutical importance of lipids.
   c) Proteins and Amino acids: Chemistry, Classification of proteins and amino acids, Reactions of proteins and amino acids, Organizational levels, Macromolecular nature of proteins, Biological and pharmaceutical importance of proteins and amino acids.
   d) Nucleic acids: Chemistry, Types (DNA, RNA, mRNA, tRNA, rRNA), Purine and Pyrimidine bases, Nucelosides, Nucelotides, Structures of nucleic acids, Biological and pharmaceutical importance of nucleic acids.
   e) Vitamins: Chemistry, Classification (Fat-soluble and water-soluble vitamins), Biological and pharmaceutical importance of vitamins.
   f) Hormones: Chemistry, Classification (Proteinous and nonproteinous hormones, amino acid derivatives, steroids), Biological and pharmaceutical importance of hormones.
   g) Enzymes: Chemistry, Classification, Mode of action, Kinetics (Michaelis Menten Equation and some modifications), Inhibition, Activation, Specificity, Allosteric enzymes, Factors affecting the rate of an enzyme-catalyzed reaction, Biological and pharmaceutical importance, Mechanism of action of some important enzymes (Chymotrypsin, Ribonuclease).

PHARM 315 PHARMACEUTICAL BIO-CHEMISTRY-I [Lab.]

Cr. Hr.: 01 Marks: 50

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

Recommended Books:

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

PHARM 316 PHYSIOLOGY-I [Th.]

Cr. Hr.: 03 Marks: 100

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 Massagers, 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 Phenomena, 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, type 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 emphases should be given on the normal physiological values and their changes during respective paqthological conditions. Further more, the physiological link will be developed with pathology as well as pharmacology.

PHARM 317 **PHYSIOLOGY-I [Lab.]**

Cr. Hr.: 01 Marks: 50

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

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

3. EYE: Visual activity, far vision, near vision and Field of vision (Perimetry).

4. CENTRAL NERVOUS SYSTEM: Nerve Muscle Preparation in frog, Effect of Temperature on muscle and Demonstration of spinal reflexes.

Recommended Books:

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

PHARM 318 **ANATOMY & HISTOLOGY [Th.]**

Cr. Hr.: 03 Marks: 100

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. Organcelles. 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. Bones structure and types of bones and joints). Muscle:
   c. Structure of — skeletal muscle, Smooth muscle, muscle.

4. INTEGUMENTARY SYSTEM:
   (a) Skin — Structure (Epidermis, dermis).
   (b) Glands of Skin, (Sweat, Sebaceous).
   (c) Hair — Structure, function.
   (d) Nail.

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

7. URINARY SYSTEM: Name and structure of organs of urinary system and their inter-relationship.

8. REPRODUCTIVE SYSTEM: Male ande Female reproductive systems. Name, structure and association of the organs.

9. ENDOCRINE SYSTEM:

   (a) Pituitary gland — structure and relation to hypothalamus.
   (b) Thyroid gland — structure.
   (c) Adrenal gland — structure.

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

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

    (b) Spinal Cord — Meninges (C.S.F. Internal Structure, Sensory and Motor Pathway, Spinal Reflexes, Peripheral spinal Nerves, Autonomic Nervous System includes Sympathetic N.S. and Parasympathetic Nervous System).

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.

PHARM 319 ANATOMY & HISTOLOGY [Lab.]

Cr. Hr.: 01 Marks: 50

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

Recommended Books:

(Anatomy)

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

Histology

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

SECOND SEMESTER

ENG 301 English-II (Communication, Technical writing & Presentation Skills)

Cr. Hr.: 04 Marks: 100

Communications Skills

Objectives: Enable the students to meet their real life communication needs.

Course Contents:

Paragraph writing; Practice in writing a good, unified and coherent paragraph
Essay writing: Introduction
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 skills; Letter/memo writing, minutes of meetings, use of library and internet
Presentation skills: Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

Technical Writing and Presentation Skills

Objectives: Enhance language skills and develop critical thinking

Course Contents:

Presentation skills;
Essay writing; Descriptive, narrative, discursive, argumentative
Academic writing; How to write a proposal for research paper/term paper, (emphasis on style, content, language, form, clarity, consistency)
Technical Report writing
Progress report writing
Note: Extensive reading is required for vocabulary building

Recommended Books:

Communication Skills

a) Grammar
   1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

b) Writing
   1. Writing. Intermediate by Marie-Chrisitine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
   2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good

for writing memos, introduction to presentations, descriptive and argumentative writing).

c) Reading

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
2. Reading and Study Skills by John Langan
3. Study Skills by Riachard Yorky.

d) Technical Writing and Presentation Skills

a) Essay Writing and Academic Writing

1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
2. College Writing Skills by John Langan. Mc-Graw-Hill Higher Education. 2004.
3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.

b) Presentation Skills

c) Reading

The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editiors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

PHARM 320 PHARMACEUTICS-II (Physical Pharmacy-II) [Th.]

Cr. Hr.: 03 Marks: 100

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

2. **PHYSICOCHEMICAL PROCESSES:**

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

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

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

   d. Miscellaneous Processes: Efflorescence, deliquescence, lyophillization, elutrition, exiccation, ignition, sublimation, fusion, calcination, adsorption, decantation, evaporation, vaporization,

centrifugation, dessication, levigation and trituration.

3. **RATE AND ORDER OF REACTIONS.**

4. **KINETIC PRINCIPLES AND STABILITY TESTING: THEORETIC CONSIDERATIONS:**

   Degradation:

a. Physical Factors: Influence of pH, temperature, ionic strength, acid-base catalysis, U.V. light.
b. Chemical Factors: Complex chemical reactions. Oxidation-reduction, hydrolysis

PHARM 321 PHARMACEUTICS-II (Physical Pharmacy-II) [Lab.]

Cr. Hr.: 01 Marks: 50

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. Partition-coefficient, surface tension, viscosity. Experiments to demonstrate some of physico-chemical processes like simple distillation, steam distillation, crystallization, Dialysis.

Recommended Books:

1. Martin, Physical Pharmacy, B I Waverly PVT, Delhi, 5th Ed., 2005.
2. Cooper and Gunns Tutorial Pharmacy, 6th Ed, CBS Publishers & Distributors, New Delhi, 2005.
3. Bentley's Pharmaceutics, All India Traveler Book Seller, New Delhi, 1996.
4. Martin P, Bustamante P and Chun, Physical & Chemical Principles of Pharmaceutical Science, AHC, 6th Ed., (1999), New York.
5. Martin AMN, Banker G S and Chun AHC Advances in Pharmaceutical Sciences. Vol 7, Academic Press, London, 1995.
6. Mill C C Casson,N. Rheology of disperse systems. Pergamon Press, New York, 1975.
7. Rienger M and Scott-Blair. G W Rheology. Academic Press, London, 1990.
8. Barry B W Advances in Pharmaceutical Sciences, Academic Press, London, 1990.
9. Sherman P Emulsion Science, Academic Press, London, 1972. 1 0.Martin A, Swarbrick J and Cammatra A
10. Physical Pharmacy, 3rd Ed., Lee & Febiger, Philadelphia. 1983.
11. Attwood D and Flocence A T Surfactant Systems.Chapman and Hall Ltd, London, 1982.

PHARM 322 PHARMACEUTICAL CHEMISTRY-II (ORGANIC-I) [Th.]

Cr. Hr.: 03 Marks: 100

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

1. **HETEROCYCLIC CHEMISTRY**

   i. Preparation and proper ties of medicinally important Hetrocyclic Compounds such as pyrool, furan, thiophene, pyridine, pyrimidine and pyrazine.
   ii. Preparation and properties of hetrocyclic compounds in which benzo-ring is fused with five and six membered ring containing one heteroatom; Indole, Quinoline and Isoquinoline.

2. **REACTION MECHANISM**

   ORGANIC REACTION MECHANISM: Arndt-Eisteret Baeyer-Villiger oxidation: Diels Alder reaction; Grignard's reaction, Metal hydride reduction and wolf krishnner reduction friedel craft's reaction, Perkin reaction, Cannizzaro reaction. Mannich Reaction

3. **REACTIVE INTERMEDIATES AND FREE RADICALS:**
   Introduction, Generation, stability and Reaction of the following intermediates: Carbocations, Carbanions, Carbenes, Nitrenes,Benzynes, Type of reactions: An Overview. Free radicals, Free radical scavengers and their applications.

4. **CARBONIUM ION REARRANGEMENTS:**

   Pinacol-Pinacolone, wigner-Meerwein, Wolf, Hofmann and Beckmann rearrangements.

5. **CARBANIONS:** Condensation reaction (Aldol condensation Favorskii rearrangement; writing reaction)

PHARM 323 PHARMACEUTICAL CHEMISTRY-II (ORGANIC-I) [Lab.]

Cr. Hr.: 01 Marks: 50

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

Recommended Books:

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

PHARM 324 PHARMACEUTICAL BIO-CHEMISTRY-II [Th.]

Cr. Hr.: 03 Marks: 100

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

a. Carbohydrates: Introduction to metabolism, 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 b-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.

PHARM 325 **PHARMACEUTICAL BIO-CHEMISTRY-II [Lab.]**
Cr. Hr.: 01 Marks: 50

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

Recommended Books:

1. M N Chaterjea, Medical Biochemistry, 7th Ed, Jaypee Brothers Medical Publishers, New Delhi, 2007.
2. Roberk Murray, Daryl K, Granner, Peter A Mayes, Victor W Rodwell Harper's Biochemistry, 28th Ed, Appleton and Lange, Lange Medical Publications, New York, 2009.
3. Albert L Lehninger Principles of Biochemistry, 4th Ed, CBS Publisher, Delhi, 2004.
4. Lubert Stryer, Biochemistry, 5th Ed, W H Freeman and Company, 2002.
5. Pamela C Champe, Richard A Harvey, Illustrated Biochemistry, 4th Ed, J Lippincot Company, 2007.
6. Harper's Biochemistry, 26th Ed, Print-Hall, New Jersey, 2003.
7. M Rafiq, Biochemistry, The Carvan Book House, Lahore, 1st Ed.
8. Montogomary, Clinical Chemistry, the C V Mosby Company, 5th Ed.
9. Conn and Stumpf, Outlines of Biochemistry, John Willey & Sons, New York, 5th Ed., 1999.
10. Lehninger, Principles of Biochemistry, 4th Ed Worth Publishers Co, New York. 2004

11. Ahmed M Essentials of Medical Biochemistry, Merit Pub Fasilabad, 1991.
12. West E S, Todd R W and Van Bruggen T J, Text Book of Biochemistry, The MacMillan Co, 1996.

PHARM 326 PHYSIOLOGY-II [Th.]

Cr. Hr.: 03 Marks: 100

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 Lunge.
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 Grain or Loss, Buffering o 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, Anatomy, 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

PHARM 327 **PHYSIOLOGY-II [Lab.]**

Cr. Hr.: 01 Marks: 50

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.

4. EYE: Visual activity, far vision, near vision and Field of vision (Perimetry).

5. CENTRAL NERVOUS SYSTEM: Nerve Muscle Preparation in frog, Effect of Temperature on muscle and Demonstration of spinal reflexes.

Recommended Books:

1. Arthur C Guyton, MD, Text Books of Medical Physiology, WB SaundersCompany,NinthEd., 2011.
2. Human Physiology by Vander Sharma &Lucino 9th Ed. 2003 McGraw Hill
3. Human Physiology by S.I. Fox 11th Ed. 2009 Amazon.

4. William F Ganong, Review of Medical Physiology, Prentice Hgall International Inc, seventeenth edition, 1995.
5. Chandi Charan Chatterjee, Human Physiology, Medical allied agency, 1994.
6. Samson Wright's Applied Physiology. Revised by Cyril AKeele and Eric Neil.
7. Spence AP and Mason EB, Human Anatomy and Physiology, Beajamin/ Cumming Publishing Inc. California, 3rd Ed.
8. Snell RS, Clinical Anatomy for Medical Students, Litle Brown & Co Inc, USA. 1992.

SECOND PROFESSIONAL

FIRST SEMESTER

IS 402 **ISLAMIC STUDIES**
Cr. Hr.: 01 Marks: 60

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.

Detail of Courses:

Introduction to Quranic Studies

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

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)

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)

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 in Makkah

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 in Madina
3) Important Lessons Derived from the life of Holy Prophet in Madina

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

Selected Study from Text of Hadith
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 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 Islam & Science

1) Basic Concepts of Islam & Science
2) Contributions of Muslims in the Development of Science
3) Quranic & Science 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 Political System of Islam

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

1) Period of Khlaft-E-Rashida
2) Period of Ummayyads
3) Period of Abbasids Social System of Islam

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

Reference Books:

1) Hameed ullah Muhammad, "Emergence of Islam" , IRI, Islamabad
2) Hameed ullah Muhammad, "Muslim Conduct of State"

3) Hameed ullah Muhammad, 'Introduction to Islam
4) Mulana Muhammad Yousaf Islahi,"
5) Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.
6) Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)
7) Mir Waliullah, "Muslim Jrisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)
8) H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989)
9) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

PHARM 410 PHARMACEUTICS-III (Dosage Form Science-I) [Th.]

Cr. Hr.: 03 Marks: 100

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. Ingredients, Product formulation.

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

4. EXTRACTION PROCESSES: Maceration: Purpose and process. Percolation: Purpose and Process. Liquid-Liquid extraction. Large scale extraction.

5. SOLVENTS USED IN PHARMACEUTICAL PREPARATIONS.

6. ORAL SOLUTIONS, SYRUPS, ELIXIRS AND SPIRITS: Solutions and their preparation, dry mixtures for solution, oral rehydrate solutions, oral colonic leverage solution. Syrup: components and preparation of Syrups. Elixirs: Preparation of elixirs, medicated and non-medicated elixirs.

7. ORAL SUSPENSIONS, EMULSIONS, MAGMA AND GELS: Preparations, Examples, and Importance.

8. 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.

9. 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.

PHARM 411 PHARMACEUTICS-III (Dosage Form Science-I) [Lab.]

Cr. Hr.: 01 Marks: 50

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

(A minimum of 10 practical will be conducted)

Recommended Books:

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

PHARM 412 PHARMACEUTICS-V (Pharmaceutical Microbiology & Immunology-I) [Th.]

Cr. Hr.: 03 Marks: 100

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. ORGANISMS:

   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.

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

3. THE FUNGI/YEAST/MOLDS.

4. THE PROTOZOA.

5. THE NORMAL FLORA: Microbiology of air, water and soil (general introduction and normal inhibitants of air, water, and soil).

PHARM 413 PHARMACEUTICS-V (Pharmaceutical Microbiology & Immunology-I) [Lab.]

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, Giemasas staining, Capsule staining, Flagella staining and Spore staining. Microbiological analysis of air, water and soil. (Note: A minimum of 10 practicals will be conducted)

Recommended Books:

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

PHARM 414 **PHARMACOLOGY & THERAPEUTICS-I [Th.]**
Cr. Hr.: 03 Marks: 100

1. GENERAL PHARMACOLOGY
   (a) Pharmacology: Definition, History, and its various branches.
   Drug: Definition and its various sources.
   (b) Routes of drug administration its 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 (t1/2β) Bioavailability and various factors affecting it. Dose, Efficacy and potency of drugs. Hypersensitivity and Idiosyncratic reactions, drug tolerance and dependence. Drug interactions. Plasma protein binding.
   (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.

PHARM 415 PHARMACOLOGY & THERAPEUTICS -I [Lab.]

Cr. Hr.: 01 Marks: 50

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. Kreb 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 demonstate the effects of vasconstrictor 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:

1. Goodman Gilman, Pharmacological basis of Therapeutics. 11th Ed McGraw-Hill Book Company, New York, 2008.
2. Winguard and Brody's, Human Pharmacology, Mosby Year Book, Boston, 1991.
3. James M Ritter and Lionel De Levis, A Text book of Clinical Pharmacology, 5th Ed Oxford University Press, New York, 2008.

4. R S Satorkar and S D Bhandarkar, Pharmacology and Pharmacotherapeutics, 19th Ed, Popular Prakashan, Bomby, 1998.
5. J D Tripathy, Essential of Medical Pharmacology, Japees Brother, New Delhi, 6th Ed., 2008.
6. D R Laurence, Clinical Pharmacology, ELBS, London, 8th Ed., 1998.
7. Katzung B G, Basic and Clinical Pharmacology, McGraw-Hill Medical Publishers, New York, 11th Ed., 2009.
8. Lippincott, Pharmacology, 4th Ed, Lippincott William & Wilkins, USA, 2008.
9. Manuchair Ebadi, Pharmacology, Little Brown & Company, London, 1993
10. Prof Dr A Qayum, Fundamentals of Experimental Pharmacology.
11. Bertram G K, Basic and Clinical Pharmacology, Paramount Publishing Business & Professional Group, USA, 10th Ed., 2007.
12. William F Ganong, W F, Review of Medical physiology, 22nd Ed, 2005 Prentice Hall International Inc, New Jersey.
13. Qayum A, Fundamentals of Experimental Pharmacology. Ghandhara University, Peshawar, 2004.
14. Humphrey P. Rang, Rang & Dale's Pharmacology, 6th Ed, 2007.

PHARM 416 PHARMACOGNOSY-I (Basic-I) [Th.]

Cr. Hr.: 03 Marks: 100

1. GENERAL INTRODUCTION: Historical Development and Scope of Pharmacognosy. Traditional system of Medicine/medicinal plants. Evolution of Modern system of Medicine (History of Modern System of Medicine). Classification of Crude Drugs with Special Emphasis to Chemical and Therapeutical System of Classification. Terminology Used in Pharmacognosy. Preparation of Crude Drugs for Commercial Market, Methods of Cultivation, Drying, Storage. Preservation, Packing, Deterioration and Adulteration of Crude Drugs. Evaluation of Crude Drugs I E Organoleptic, Microscopic, Physical, Chemical and Biological.

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

S. No.	Families	Crude Drugs
a.	Ranunculanceae	Aconitum, Larkspur, Pulsatilla, Hydrastis
b.	Papaveraaceae	Papaver somniferum, Sanguinaria, Canadensis
c.	Leguminosae	Acacia, Glycyrrhiza, Senna, Cassia, Tamarind
d.	Umbelliferae	Fennel, Carum, Coriander, Conium, Asafoetida
e.	Apocynaceae	Rauwolfia, Catharanthus
f.	Asclepiadaceae	Gymnema sylvestre, Calotropisgigantea
g.	Compositae	Artemisia, Silybum marianum, Echinaceae, Arctium lappa
h.	Solanaceae	Belladonna, Hycscyamus, Stramonium Capsicum

i.	Scrophulariaceae	Digitalis, Verbascum (Mullien).
j.	Labiatae	Peppermint, Thyme, Spearmint, Salvia, Ocimum
k.	Liliaceae	Garlic, Colchicum, Aloe
l.	Zingiberaceae	Ginger, Curcuma

3. Evaluation and Adulteration of Crude Drugs
   Organoleptic study, physical evaluation, microscopic evaluation, types of adulteration, inferiority, spoilage, admixture, sophistication and substitution of crude drugs.

PHARM 417 **PHARMACOGNOSY-I [Lab.]**
Cr. Hr.: 01 Marks: 50

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:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York (1955-1977).
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers (2000).
3. Ayurvedic Pharmacognosy,Partab Chauhan, Ed., Sonali Publications, New Delhi (2007).
4. Baker B.M. and Bender D.A. Vitamins in Medicine, Vol. 1-2 (1980-82)
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York (2000).
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York (1981).
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart (1994).
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, (2005).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester (1997).
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa (2003).
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad (2003).

12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London (2007).
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia (2001).
14. Poisonous Plants of all Countries, A Bernard Smith, 2nd ed., Peridical Expert Book (1988).
15. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, (1988).
16. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, (2005).
17. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester (1999).
18. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol (1975).
19. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher (2009).
20. Tyler V.E., Brady E.R. and Robbers J.E. Pharmacognosy, 9th ed., Lea & Febiger, Philadelphia (1988).

PHARM 418 PHARMACY PRACTICE-1 PHARMACEUTICAL MATHEMATICS) [Th.]

Cr. Hr.: 02 Marks: 100

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 Ellips.

Recommended Books:

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

2. Daniel W W Bio-Statistics, Foundation for Analysis in Health Science. 9th Ed, 2008.
3. Zar J H, Biostatistical analysis, 4th Ed, Francis Hall, NJ, U.S.A. 1999.
4. Nilton, J S and Tsokos, J D, Statistical Methods in Biological and health Sciences, McGrew-Hill. 1983.
5. Chaudhry S A and Kmal S, Introduction to Statistical Theory, Part-I and Part-II, Ilmi Kitab Khana, Urdu Bazar, Lahore. 1996.
6. Samuels M, Statistics for the life sciences, 3rd Ed, Dellen Pub Co SF, USA. Introduction to Statistics, Macmillam Pub Co, NY 2002.
7. Ahmed B and Khan M, Mathematics for Pharmacists, Arsalan Paper Mart, Multan, 1993.

SECOND SEMESTER

PS 403 PAKISTAN STUDIES

Cr. Hr.: 01 Marks: 40

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.

Course Outline:

1. Historical Perspective
   a. Ideological rationale with special reference to Sir Syed Ahmed Khan, 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:

1. Burki, Shahid Javed. *State & Society in Pakistan,* The Macmillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy.* Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development.* Lahore, 1994.
5. Wilcox, Wayne.*The Emergence of Banglades.,* Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota,* Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.
7. Amin, Tahir. *Ethno - National Movement in Pakistan,* Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development.* Kent England: WmDawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh.* Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan,* Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
11. Sayeed, Khalid Bin. *The Political System of Pakistan.* Boston: Houghton Mifflin, 1967.
12. Aziz, K.K. *Party, Politics in Pakistan,* Islamabad: National Commission on Historical and Cultural Research, 1976.
13. Muhammad Waseem, Pakistan Under Martial Law, Lahore: Vanguard, 1987.
14. Haq, Noor ul. *Making of Pakistan: The Military Perspective.* Islamabad: National Commission on Historical and Cultural Research, 1993.

PHARM 420 PHARMACEUTICS-V (Dosage Form Science-II) [Th.]

Cr. Hr.: 03 Marks: 100

1. SUPPOSITORIES AND VAGINAL SUPPOSITORIES: Semi-solid Preparations, Suppositories bases, preparation, packaging and storage, Solutions/Enemas.

2. AEROSOLS, INHALATIONS AND SPRAYS: Aerosol: Principle, container and valve assembly, Propellants, filling, testing, packaging, labeling 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, their 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.

PHARM 421 PHARMACEUTICS-IV (Dosage Form Science-II) [Lab.]

Cr. Hr.: 01 Marks: 50

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

(A minimum of 10 practical will be conducted)

Recommended Books:

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

PHARM 422 PHARMACEUTICS-VI (Microbiology & Imm Unology-II) [Th.]

Cr. Hr.: 03 Marks: 100

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

2. IMMUNOLOGY: Introduction, Types of Immunity: Specific and non-specific (Cellular basis of Immune response. Immunity, autoimmunity, tolerance. Antigen. Anti-bodies). Antigen — Anti-body 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 AND HOSPITAL HYGIENE AND GOOD MANUFACT-URING PRACTICE:
   Introduction, Control of Microbial contamination during manufacture, Mnaufacture of Sterile products, A Guide to Current Good Pharmaceutical Manufacturing Practices.

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

PHARM 423 PHARMACEUTICS-V (Pharmaceutical Microbiology & Immunology-II) [Lab.]

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, Giemasas staining, Capsule staining, Flagella staining and Spore staining. Microbiological analysis of air, water and soil. (Note: A minimum of 10 practicals will be conducted)

Recommended Books:

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

PHARM 424 PHARMACOLOGY & THERAPEUTICS-II [Th.]

Cr. Hr.: 03 Marks: 100

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

2. DRUGS ACTING ON RESPIRATORY SYSTEM:
   i. Drugs used for cough (Anti-tussives, Expectorants and Mucolytic Agents).

   ii. Drugs used for 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-VESCULAR 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.

PHARM 425 PHARMACOLOGY & THERAPEUTICS-II [Lab.]

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. Preparation of standard solution. Ringer solution. Tyrode solution. Kreb 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 demonstate the effects of vasconstrictor 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.

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

Recommended Books:

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

PHARM 426 PHARMACOGNOSY-II (Basic-II) [Th.]

Cr. Hr.: 03 Marks: 100

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, antivenins, 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.

PHARM 427 PHARMACOGNOSY-II [Lab.]

Cr. Hr.: 01 Marks: 50

Note: Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters). Microscopic examination of powders and sections of plant drugs.

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

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

Recommended Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York (1955-1977).
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers (2000).
3. Ayurvedic Pharmacognosy,Partab Chauhan, Ed., Sonali Publications, New Delhi (2007).
4. Baker B.M. and Bender D.A. Vitamins in Medicine, Vol. 1-2 (1980-82)
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York (2000).
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York (1981).
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart (1994).
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, (2005).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester (1997).
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa (2003).
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad (2003).
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London (2007).
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia (2001).
14. Poisonous Plants of all Countries, A Bernard Smith, 2nd ed., Peridical Expert Book (1988).
15. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, (1988).
16. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, (2005).
17. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester (1999).
18. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol (1975).
19. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher (2009).
20. Tyler V.E., Brady E.R. and Robbers J.E. Pharmacognosy, 9th ed., Lea & Febiger, Philadelphia (1988).

PHARM 428 PHARMACY PRACTICE-II (PHARMACEUTICAL STATISTICS) [Th.]

Cr. Hr.: 02 Marks: 100

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

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

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

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

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

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

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

8. STUDENT “t”, “F” and Chi-Square Distributions: Test of Significance based on “t” , “F” and Chi-Square Distributions.

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

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

Recommended Books:

1. C H Edvards. Jr. and David E Penney, Calculus and Analytic Geometry, Prentice- Hall, Inc, A division of Sinon & Schustor Englewood Gliffs, New Jersey 07632, USA. 1995.
2. Daniel W W Bio-Statistics, Foundation for Analysis in Health Science. 9th Ed, 2008.

3. Zar J H, Biostatistical analysis, 4th Ed, Francis Hall, NJ, U.S.A. 1999.
4. Nilton, J S and Tsokos, J D, Statistical Methods in Biological and health Sciences, McGrew-Hill. 1983.
5. Chaudhry S A and Kmal S, Introduction to Statistical Theory, Part-I and Part-II, Ilmi Kitab Khana, Urdu Bazar, Lahore. 1996.
6. Samuels M, Statistics for the life sciences,3rd Ed, Dellen Pub
7. Co SF, USA.
8. Introduction to Statistics, Macmillam Pub Co, NY.2002.
9. Ahmed B and Khan M, Mathematics for Pharmacists, Arsalan Paper Mart, Multan, 1993.

THIRD PROFESSIONAL

FIRST SEMESTER

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

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.

PHARM 511 PHARMACY PRACTICE-III (Dispensing Pharmacy) [Lab.]

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. Practical introduction to prescription-handling, interpretation, filling and Labeling.

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

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

Incompatibility: Practical Importance of Incompatibilities

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

Cosmetics: Lipstick, talcum powder, after shave lotion, shaving cream.

(Note: A minimum of 20 practicals will be conducted).

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

Recommended Books:

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

PHARM 512 PHARMACEUTICAL CHEMISTRY-III (Pharmaceutical Analysis-I) [Th.]

Cr. Hr.: 03 Marks: 100

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.

SPECTROSCOPIC METHODS:

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

Atomic Absorption and Emission Spectroscopy; Molecular fluorescence spectroscopy, Flame Photometry; I.R. Spectroscopy; Mass Spectroscopy; NMR Spectroscopy; U.V./Visible Spectroscopy.

PHARM 513 PHARMACEUTICAL CHEMISTRY-III (Pharmaceutical Analysis-I) [Lab.]

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 requirements, e.g. Determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques. Determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques.

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

Recommended Books

1. Lough W J, High Performance Liquid Chromatography, Blacki Academic Press, New York, 1996.
2. William Kemp, Organic Spectroscopy, 3rd Ed, Ellsi Horwood, London, 2008.
3. M Aminuddin & Javed Iqbal, Theory and Practice of Chromatography, (2000).
4. A H Beckett and J B Stennlake, Practical Pharmaceutical Chemistry, 4th Ed, Part I and II, the Aulton Press, London. 2001.

5. A M Knevel and F E Digangi, Jenkin's quantitative Pharmaceutical Chemistry, 7th Ed, McGraw-Hill Book company, New York.1977.
6. A Braithwaite and F J Smith, Chromatographic Methods, 5th Ed, Chapman and Hall, London. 1995.
7. E Heftmann, Chromatography, 6th Ed, Von Nostrond Reinheld Co, New York, 2004.
8. A Pryde and M J Gilbert, Applications of High Performance Liquid Chromatography, Chapman & Hall, London, 1979.
9. E Stahl, Thin Layer Chromatography, 2nd Ed, Springer-Verlag, Berlin, 1969.
10. R Hamilton, Introduction to HPLC, P A Sewell, Chapman & Hall, London, 1982.

PHARM 514 PHARMACOLOGY & THERAPEUTICS-III [Th.]

Cr. Hr.: 03 Marks: 100

Objectives:

On completion of this course student should:

1. Know the aetiology of disease,
2. Be able to classify the drugs used for its treatment.
3. Understand the mechanism of drug action
4. Be able to describe pharmacokinetics, indication, contraindication, dose and dosage, adverse effects, cautions and pre-cautions and their interaction with other drugs and food.

1. DRUGS ACTING ON CENTRAL NERVOUS SYSTEM
   - (a) Sedatives & Hypnotic
   - (b) Anxiolytics and antidepressants and antimanic drugs
   - (c) Antiepileptics
   - (d) Antiparkinsonian and drug used in other neurodegenerative diseases.
   - (e) Antipsychotics
   - (f) Opioids analgesics
   - (g) Therapeutic gases (Oxygen, Carbon-dioxide, Nitric oxide and Helium.
   - (h) Cerebral Stimulants, Medullary stimulants, Spinal Cord Stimulants.
   - (i) Anesthetics: General and local

NON STEROIDAL & ANTI-INFLAMMATORY DRUGS, DISEASE MODIFYING DRUGS ANTIRHEUNATIC DRUGS, NON OPIOIDS ANALGESICS AND DRUGS USED IN THE TREATMENT OF GOUT

PHARM 515 PHARMACOLOGY & THERAPEUTICS-III [Lab.]

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. To study the convulsant effects of strychnine and picrotoxin in frogs and to determine the site of action. To identify the unknown (convulsant) drug and determine its site of action. To study the effects of Adrenaline on Human Eyes. To study the effects of Pilocarpine on Human Eyes. To study the effect of Homatropine on Human Eyes. To identify and observe the effects of unknown drugs on Human Eyes. To study the effects of local anaesthetic drugs on human and the nerve plexus of frog. To identify and differentiate the effects of unknown drug on human and the nerve plexus of frog. To demonstrate the effects of Acetylcholine on the Rectus abdominus muscle of frog and competitive pharmacological antagonism by Neuromuscular blocking agent e.g. Gallamine. To identify the unknown drug by performing pharmacological competitive antagonism on Rectus abdominus muscle of Frog. To study the anti-coagulant effects of Heparin and oral anti-coagulants on Rabbits. To identify the unknown anticoagulant drug using Rabbits. To demonstrate the graded Dose-Response curve of Acetylcholine on Rabbit intestine. To identify unknown concentration of Acetycholine from graded Dose-Response curves. To demonstrate the general anesthetic effect on rabbits. To demonstrate the effect of sedatives and hypnotics on rabbits. To demonstrate the anti-nociceptive (nalagesic) effect on mice. To demonstrate antidepressant effect in rats (forced swimming test, tail suspension test Yohimbin lethality test).

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

Recommended Books:

1. Goodman Gilman, Pharmacological basis of therapeutics. 11th Ed, McGraw-Hill Book Company, New York, 2008.
2. Winguard and Brody, Human Pharmacology, Mosby Year Book, Boston, 1991.
3. James M Ritter and Lionel De Levis, A Text book of Clinical Pharmacology, 5th Ed, Oxford University Press, New York, 2008.
4. R S Satorkar and S D Bhandarkar, Pharmacology and Pharmaco-therapeutics, Popular Prakashan, Bomby, 1998.
5. J D Tripathy, Essential of Medical Pharmacology, Japees Brother, New Delhi, 6th Ed, 2008.
6. D R Laurance, Clinical Pharmacology, ELBS, London, 8th Ed., 1998.
7. Katzung B G, Basic and Clinical Pharmacology, McGraw-Hill Medical

Publishers, New York, 11th Ed., 2009.
8. Lippincott, Pharmacology, 4th Ed, Lippincott Williams & Wilkins, USA, 2008.
9. Manuchair Edabi, Pharmacology, Little Brown & Company, London, 1993.
10. Prof Dr A Qayum, Fundamentals of Experimental Pharmacology.
11. Bertram G K, Basic and Clinical Pharmacology, Paramount Publishing Business & Professional Group, USA, 6th Ed., 1995.
12. William F Ganong, W F, Review of Medical physiology, 22nd Ed, 2005 Prentice Hall International Inc, New Jersey.
13. Qayum A, Fundamentals of Experimental Pharmacology. Ghandhara University, Peshawar, 2004.
14. Pharmacology by Ran & Dell, 6th edition.

PHARM 516 PHARMACOGNOSY-III (Advanced-I) [Th.]

Cr. Hr.: 03 Marks: 100

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, infra-red, mass, nuclear magnetic resonance (^{1}H-NMR and ^{13}C-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, Cassification, 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) Steroidal 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) Anthroquinone glycosides: Cascara, Aloe, Rhubarb, Cochineal and Senna.
   (c) Saponin glycosides: Glycyrrhiza, Sarsaparilla.
   (d) Cyanophore glycosides: Wild cherry.
   (e) Isothiocyanate glycosides: Black Mustard.
   (f) Lactone glycosides: Cantharide.
   (g) Aldehyde glycosides: Vanilla.
   (h) Miscellaneous glycosides: Gentian, Quassia, Dioscorea.

5. Plant Steroids
   Introduction, extraction, isolation, nomenclature, sources and uses of bile acids, plant sterols, steroidal sapogenins, steroid hormones, withanolides and ecdysons.
6. Lipids
   Introduction, classification, source, active constituents and pharmacological uses of:

   (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.

PHARM 517 **PHARMACOGNOSY-III (Advanced-I) [Lab.]**
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. Extraction of the active constituents of crude drugs and chemical tests for their identification. Isolation and separation of active constituents of crude drugs by paper and thin layer chromatography.

Also include the following experiments

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

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

Recommended Books:

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

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

PHARM 518 **PATHOLOGY-I [Th.]**
Cr. Hr.: 03 Marks: 100

1. SCOPE OF PATHOLOGY & CONCEPT OF DISEASES

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

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

4. SPECIFIC: 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.

PHARM 519 **PATHOLOGY-I [Lab.]**
Cr. Hr.: 01 Marks: 50

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, Sq. Cell Carcinoma, Basal Cell Carcinoma, Transitional Cell Carcinoma, Adenocarcinoma, Fibrocarcinoma, Rhadomyo sarcoma, Leomyo sarcoma, Lymphosarcoma, Liposarcoma, Reticular Cell Sarcoma, Hodgkins disease, Breast Carcinoma, Osteogenic Sarcoma, Osteoclastoma, Hapatitis, Diabetes.
Examiantion 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.
Tests for various Specimens of Clinical Importance
Techniques of Clinical Blood Examination for various disases, Gastric Analysis, Tests for liver function, Renal function test, Tests for endocrine abnormalities, Biopsies and cytologic techniques.

Recommended Books:

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

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

SECOND SEMESTER

PHARM 520 PHARMACY PRACTICE-IV (Community, Social & Administrative Pharmacy) [Th.]
Cr. Hr.: 03 Marks: 100

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 Utilisation 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 and interpretation. Background, philosophy and use of complementary and alternative therapies including herbal medicines, homeopathy, acupuncture, acupressure, Bach Flower Remedies, aromatherapy and reflexology.

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

Recommended Books:

1. Roy Robertson, Management of Drug Users in the Community: A practical Handbook, 1998.
2. Remington's Pharmaceutical Sciences, Mack Publishing Company, USA, 2001
3. Martindale's Extra Pharmacopeia, 2009.
4. William T. O'Donohue, Eric R. Levensky, Promoting treatment adherence: a

practical handbook for health care providers; Sage Publications, 2006
5. Shane P. Desselle, David P. Zgarrick, Pharmacy management: essentials for all practice settings - McGraw-Hill Professional, 2004.
6. Richard N. Spivey, Albert I. Wertheimer, T. Donald Rucker, International pharmaceutical services: Routledge, 1992

PHARM 522 PHARMACEUTICAL CHEMISTRY-IV (Pharmaceutical Analysis-II) [Th.]

Cr. Hr.: 03 Marks: 100

1. CHROMATOGRAPHIC METHODS: Column Chromatography, Thin Layer Chromatography, Gas Liquid Chromatography, HPLC and GC-MS, CapillaryElectrophoresis.

2. ELECTRO CHEMICAL METHODS: Potentiometry, Polarography and Radiochemical Techniques.
3. THERMAL ANALYSIS: Differential Scanning Calorimetry, Differential Thermal Analysis, Thermo Gravimetric Analysis
4. TITRIMETRIC ANALYSIS: Titrimetric analysis of drugs based on neutralization, hydrolysis, oxidation, reduction and non-aqueous titration.
5. OCCURANCE, 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.

PHARM 523 PHARMACEUTICAL CHEMISTRY-IV Pharmaceutical Analysis-II) [Lab.]

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 requirements, e.g. Determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques. Determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques.

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

Recommended Books:

1. Lough W J, High Performance Liquid Chromatography, Blacki Academic Press, New York, 1996.
2. William Kemp, Organic Spectroscopy, 3rd Ed, Ellsi Horwood, London, 2008.
3. M Aminuddin & Javed Iqbal, Theory and Practice of Chromatography, (2000).
4. A H Beckett and J B Stennlake, Practical Pharmaceutical Chemistry, 4th Ed,

Part I and II, the Aulton Press, London. 2001.
5. A M Knevel and F E Digangi, Jenkin's quantitative Pharmaceutical Chemistry, 7th Ed, McGraw-Hill Book company, New York.1977.
6. A Braithwaite and F J Smith, Chromatographic Methods, 5th Ed, Chapman and Hall, London. 1995.
7. E Heftmann, Chromatography, 6th Ed, Von Nostrond Reinheld Co, New York, 2004.
8. A Pryde and M J Gilbert, Applications of High Performance Liquid Chromatography, Chapman & Hall, London, 1979.
9. E Stahl, Thin Layer Chromatography, 2nd Ed, Springer-Verlag, Berlin, 1969.
10. R Hamilton, Introduction to HPLC, P A Sewell, Chapman & Hall, London, 1982.

PHARM 524 PHARMACOLOGY & THERAPEUTICS-IV [Th.]

Cr. Hr.: 03 Marks: 100

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, anti-protozoals (anti- malarias, anti-amebiasis, , anthelmintics and anti leishmanials) and antimycobacterial drugs.
(e) Anti-neoplastic drugs,

2. IMMUNOPHARMACOLOGY:

Pharmacology of immune-suppressants and stimulants

3. TOXICOLOGY

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

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.

PHARM 525 PHARMACOLOGY & THERAPEUTICS-IV [Lab.]

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. To study the convulsant effects of strychnine and picrotoxin in frogs and to determine the site of action. To identify the unknown (convulsant) drug and determine its site of action. To study the effects of Adrenaline on Human Eyes. To study the effects of Pilocarpine on Human Eyes. To study the effect of Homatropine on Human Eyes. To identify and observe the effects of unknown drugs on Human Eyes. To study the effects of local anaesthetic drugs on human and the nerve plexus of frog. To identify and differentiate the effects of unknown drug on human and the nerve plexus of frog. To demonstrate the effects of Acetylcholine on the Rectus abdominus muscle of frog and competitive pharmacological antagonism by Neuromuscular blocking agent e.g. Gallamine. To identify the unknown drug by performing pharmacological competitive antagonism on Rectus abdominus muscle of Frog. To study the anti-coagulant effects of Heparin and oral anti-coagulants on Rabbits. To identify the unknown anticoagulant drug using Rabbits. To demonstrate the graded Dose-Response curve of Acetylcholine on Rabbit intestine. To identify unknown concentration of Acetycholine from graded Dose-Response curves. To demonstrate the general anesthetic effect on rabbits. To demonstrate the effect of sedatives and hypnotics on rabbits. To demonstrate the anti-nociceptive (nalagesic) effect on mice. To demonstrate antidepressant effect in rats (forced swimming test, tail suspension test Yohimbin lethality test).

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

Recommended Books:

1. Goodman Gilman, Pharmacological basis of therapeutics. 11th Ed, McGraw-Hill Book Company, New York, 2008.
2. Winguard and Brody, Human Pharmacology, Mosby Year Book, Boston, 1991.
3. James M Ritter and Lionel De Levis, A Text book of Clinical Pharmacology, 5th Ed, Oxford University Press, New York, 2008.
4. R S Satorkar and S D Bhandarkar, Pharmacology and Pharmaco-therapeutics, Popular Prakashan, Bomby, 1998.
5. J D Tripathy, Essential of Medical Pharmacology, Japees Brother, New Delhi, 6th Ed, 2008.
6. D R Laurance, Clinical Pharmacology, ELBS, London, 8th Ed., 1998.
7. Katzung B G, Basic and Clinical Pharmacology, McGraw-Hill Medical

Publishers, New York, 11th Ed., 2009.
8. Lippincott, Pharmacology, 4th Ed, Lippincott Williams & Wilkins, USA, 2008.
9. Manuchair Edabi, Pharmacology, Little Brown & Company, London, 1993.
10. Prof Dr A Qayum, Fundamentals of Experimental Pharmacology.
11. Bertram G K, Basic and Clinical Pharmacology, Paramount Publishing Business & Professional Group, USA, 6th Ed., 1995.
12. William F Ganong, W F, Review of Medical physiology, 22nd Ed, 2005 Prentice Hall International Inc, New Jersey.
13. Qayum A, Fundamentals of Experimental Pharmacology. Ghandhara University, Peshawar, 2004.
14. Pharmacology by Ran & Dell, 6th edition.

PHARM 526 PHARMACOGNOSY-IV (Advanced-II) [Th.]

Cr. Hr.: 03 Marks: 100.

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, myroblan, catechu, nutgall, castanea, and krameria.

4. Natural Toxicants

   a) General Introduction to Plant Toxicology
      Definition, clasificatand 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, cyanognic), Alkaloids

(imidazole, pyrrolizidine, tropane).

c) Lower Plant Toxins
Bacterial toxins *(Staphylococcus aureus, Clostridium botulinum),* Algal toxins *(Microcystis aeruginosa,* Cyanobecteria, *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 *Catharanthus roseus*, *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, Momordica charantia, 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.*

PHARM 527 **PHARMACOGNOSY-IV (Advanced-II) [Lab.]**
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. Extraction of the active constituents of crude drugs and chemical tests for their identification. Isolation and separation of active constituents of crude drugs by paper and thin layer chromatography.

Also include the following experiments

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

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

Recommended Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York (1955-1977).
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers (2000).
3. Ayurvedic Pharmacognosy,Partab Chauhan, Ed., Sonali Publications, New Delhi (2007).
4. Baker B.M. and Bender D.A. Vitamins in Medicine, Vol. 1-2 (1980-82)
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York (2000).
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York (1981).
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart (1994).
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, (2005).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester (1997).
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa (2003).
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad (2003).
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London (2007).
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia (2001).
14. Poisonous Plants of all Countries, A Bernard Smith, 2nd ed., Peridical Expert Book (1988).

15. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, (1988).
16. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, (2005).
17. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester (1999).
18. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol (1975).
19. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher (2009).
20. Tyler V.E., Brady E.R. and Robbers J.E. Pharmacognosy, 9th ed., Lea & Febiger, Philadelphia (1988).

PHARM 528 PHARMACY PRACTICE-V (Computer and its applications in Pharmacy) [Th.]

Cr. Hr.: 03 Marks: 100

1. Fundamentals basic concept of computers
    - History of Data Processing
    - Types of Computers
    - Components of a Computer
    - Computer System and Business Computer System
    - Backing Storage Devices
    - Unit of Memory
    - Viruses and Anti-viruses Issues
2. Research Methodologies.
3. System Analysis and Design
    - What is a System?
    - Steps in system life cycle
    - Data Gathering and Data Analysis
    - Designing a New System
    - Development and Implementation of New System
    - Documentation.
4. Data Processing
    - Data Processing
    - The Data Processing Cycle
    - The Collection and Computing of data
    - Manual collection of data
    - The main methods of data input
    - Devices used to collect data
    - Data Verification

- Data Validation
- Output and Recording of data
- Types of data processing systems
- Types of Computer Operation
- Batch Processing and Real-time Processing

5. Application of Computers in Hospital Pharmacy
    - Patterns of Computer use in Hospital Pharmacy,
    - Patient record database management,
    - Medication order entry –
    - Drug labels and list –
    - Intravenous solution and admixture,
    - patient medication profiles,
    - Inventory control,
    - Management report & Statistics.
6. Application of Computer in Community Pharmacy:
    - Computerizing the Prescription Dispensing process,
    - Use of Computers for Pharmaceutical Care in community pharmacy,
    - Accounting and General ledger system.
7. Application of Drug Information Retrieval & Storage :
    - Introduction
    - Advantages of Computerized Literature
    - 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.

PHARM 529 PHARMACY PRACTICE-V (Computer and its applications in Pharmacy) [Lab.]

Cr. Hr.: 01 Marks: 50

1. Internet and E-mail
    - Internet and Microsoft Internet Explorer 5
    - Addresses, Links and Downloading
    - Searching the Internet
    - E-mail and Newsgroups
    - Favorites, security and Customizing Explorer

2. Web Page Development
    - Introduction to Front-page
    - Creating a First Web site
    - Basic Formatting Techniques
    - Manipulating Tables within Front-page
    - Front-page, Picture and Multimedia
    - Hyper linking, Bookmarks and Image Maps
    - Introducing Front-page “components”
    - Front-page and Frames

- Managing your Web
- Good site design, Publishing and Publicizing

3. Data presentation Skills:
   - MS-Word,
   - MS-Excel,
   - MS-Power point

4. Understanding and Application of Complete Statistical Package like:

   - SPSS,
   - Kinetica,
   - Med Calc.

Recommended Books:

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

FOURTH PROFESSIONAL

FIRST SEMESTER

PHARM 610 PHARMACY PRACTICE-VI (Hospital Pharmacy-I) [Th.]

Cr. Hr.: 03 Marks: 100

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 etc.
   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:

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

PHARM 612 PHARMACY PRACTICE-VII (Clinical Pharmacy-I) [Th.]

Cr. Hr.: 03 Marks: 100

1. GENERAL INTRODUCTION TO CLINICAL PHARMACY: Terminologies, Basic Components and Scope.
2. PATIENT PROFILE & PATIENT COUNSELING:
   a. Patient disease profile
   b. Taking case History
   c. Drug Profile of 25 Drugs (Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cepahlosporins, Chlorpheniramine, Cimetidine, Digoxin, Dobutamine, Dopamine,

Fluroquinolone, Frusemide, Lactulose, Macrolides, Metoclopramide, Morphine/Pethedine, Nifedipine, NSAIDS, ORS, Penicillins, Prednisolone, Salbutamol, Vancomycin)

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.

5. DRUG INTERACTIONS: Mechanism, Physiological factors affecting interaction, Types and level of drug interactions, Role of pharmacist in evaluating drug interactions & 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, General toxicity, Toxicity following drug withdrawal, Detection, Management of ADR, reporting of ADR in light of international health monitoring system.

PHARM 613 PHARMACY PRACTICE-VII (ClinicalPharmacy-I) [Lab.]

Cr. Hr.: 01 Marks: 50

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

Recommended Books:

1. Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Levingstone, London, 4th Ed., 2003.
2. Guard Paul, A Behavioral Approach to Pharmacy Practice, Black Well, USA, 2000.
3. Herfindal Gourley, Clinical Pharmacy & Therapeutics, 4th Ed, William & Willkins, London, 1992.
4. A J Winfield, Pharmaceutical Practice, Churchill Levingstone, London, 3rd Ed., 1998.
5. Kavin Taylor, Pharmacy Practice, 2nd Ed, Taylor & Francis, New York, 1998.

6. Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 4th Ed., Sarrison, Inc, North Carolina, USA. 2001.
7. Simon Cook, Clinical Studies Management, a Practical Guide to Success, Sue Horwood Publishing limited, and West Sussex UK. 2004.
8. Joseph T Dipiro, Encyclopedia of Clinical Pharmacy. Marcel Dekker Publishing, 2003.
9. Joseph T Dipiro, Encyclopedia of Pharmacy. Marcel Dekker Publishing 2002.
10. Mellainie J Rantucci, Pharmacist Talking with Patients, 2nd Ed, 2006.
11. Smith GDG and Aronson J K, Oxford Text Book of Clinical Pharmacology and Drug Therapy, Oxford University Press, UK, 2002.
12. Hansten P and Horn J, Drug interactions. Lee & Febiger, Philadelphia,USA, 1989.

PHARM 614 PHARMACEUTICS-VII (Industrial Pharmacy-I) [Th.]
Cr. Hr.: 03 Marks: 100

1. MASS TRANSFER.

2. HEAT TRANSFER.

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

4. MIXING: Fundamentals, Mechanisms, Mixing Equipment used in Liquid/Liquid, Liquid/Solid and solid/solid mixing, 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. COMMUNITION (SIZE REDUCTION): Reasons for size reduction, Factors affecting size reduction, size analysis, Sieving, Energy Mills (Ball Mill, Endrumer, Edge Rumer, Disintegrant, Colloid Mill, Hammer Mill, Cutter Mill, and Fluid Energy Mill etc.).

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

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

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

PHARM 615 PHARMACEUTICS-VII (Industrial Pharmacy-I) [Lab.]
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. Manufacture of Tablets by Wet Granulation Method, by Slugging and by Direct Compression. Coating of Tablets (Sugar Coating, Film coatingand Enteric Coating). Clarification of liquids by various processes. Size Reduction. Homogenization. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables. Capsule filling by semi automatic machines. Manufacture of sustained action drugs. Tablets Tests like Disintegration. Dissolution. Friability. Hardness and thickness tests. Determination of weight variation in tablets. Density of powder. Particle size analysis.

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

Recommended Books:

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

PHARM 616 PHARMACEUTICS-VIII (Biopharmaceutics-I) [Th.]
Cr. Hr.: 03 Marks: 100

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

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 HALFLIFE 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. BIOAVAILABILITY AND BIOEQUIVALENCE
   a. Introduction.
   b. Bioavailability types, parameters, significance and study protocol.
   c. Methods of Assessment of Bioavailability
   d. Bioequivalence study designs, components and application, report format

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.
      Statistical Moment Theory; MRT for various compartment models; Physiological Pharmacokinetic model.

PHARM 617 PHARMACEUTICS-VIII (Biopharmaceutics-I) [Lab.]
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. 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. In humans. Renal excretion of drugs or drug disposition.

Recommended Books:

1. Leon Shargel, Applied Pharmacokinetics and Biopharmaceutics, Appleton & Lange, New York, 5th Ed., 2008.
2. Malcoln Rouland, Thomous N Tozer, Clinical Pharmacokinetics, William & Willkins, London, 1995.
3. Milo Gibaldi, Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Marchel & Dakker Inc, New York, 2008.
4. Gibbson and Skett, Introduction to Drug Metabolism, 3rd Ed, Champ & Hall, London, 2001.
5. Robert E Notari, Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Marchel & Dakker Inc, New York, 1988.
6. Sarfraz Niazi, Text Book of Biopharmaceutics & Clinical Pharmacokinetics. Appleton-Century-Crofts, New York, 1985.
7. Gul Majid Khan, Biopharmaceutics: Text Book for

Pharmacy Students & Working Pharmacists *[ISBN978-969-9101-00-7]*
8. Gul Majid Khan, Text Book of Biopharmaceutics & Pharmacokinetics for Post Graduate Students
9. Gul Majid Khan, Laboratory Manual of Biopharmaceutics & Pharmacokinetics *[ISBN 978-969-9101-02-1]*
10. Stephen H Curry, Drug disposition and pharmacokinetics, Black Well Scientific Publishing, Oxford, 1983.
11. Avraham Yacobi, Toxicokinetics and New Drug Development, Paramount Press, New York, 1989.
12. P Macheras, C Reppas and J B Dressman, Biopharmaceutics of orally administered drugs, Ellis Horwood Limited, London (1995).
13. Albert P Li, *In vitro* approaches for evaluation of drug efficacy and toxicity, CRC Press LLC USA, 2004.
14. Ronald D Schoenwald, Pharmacokinetics in drug discovery and Development, CRC Press LLC, USA, 2002.

PHARM 618 PHARMACEUTICS-IX (Pharmaceutical Quality Management-I) [Th.]
Cr. Hr.: 03 Marks: 100

1. INTRODUCTION:
   (a) Basic concepts about introduction of pharmaceutical industry in relevance to quality assurance and quality control departments, testing, quality management system, quality assurance, quality control, Standard.

   (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 ingredients and dissolution tests of Powders, Granules, Tablets and Capsules.

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

4. QUALITY CONTROL OF SUPPOSITORIES: Disintegration test, Uniformity of weight, Assay of active ingredients, 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 ingredients.

PHARM 619 PHARMACEUTICS-IX (Pharmaceutical Quality Management-I) [Lab.]
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. 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 practical will be performed)

Recommended Books:

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

SECOND SEMESTER

PHARM 620 PHARMACY PRACTICE-VIII (Hospital Pharmacy-II) [Th.]
Cr. Hr.: 03 Marks: 100

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 Hyperailimentation.

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

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

7. THE PHYSICAL PLANT AND ITS EQUIPMENT

8. INVESTIGATIONAL USE OF DRUGS.

9. HEALTH ACCESSORIES.

10. SURGICAL SUPPLIES.

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

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

Recommended Books:

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

PHARM 622 PHARMACY PRACTICE-IX (ClinicalPharmacy-II) [Th.]
Cr. Hr.: 03 Marks: 100

1. PHARMACOTHERAPY PLAN

I. Develop, Implement, and Monitor Drug Therapy Plans

A. Establish desired therapeutic outcomes.
B. Consider drug and non-drug therapy alternatives.
C. Develop drug therapy plans that are patient-specific, comprehensive, logical, practical, consider current evidence-based medicine recommendations, include strategies for prevention, and include patient education.
D. Establish a plan for therapeutic drug monitoring that includes accurate documentation of population and patient-specific parameters, dosing

history/administration times, monitoring parameters, and daily SOAP notes/plans.

E. Develop and implement the pharmacotherapeutic plan promptly, efficiently, accurately, and effectively.

F. Use an effective patient monitoring system (monitoring forms).

G. Monitor the patient and follow up at appropriate intervals.

H. Revise drug therapy plans on an ongoing basis.

I. Ensure continuity of pharmaceutical care to and from the acute and ambulatory care patient care settings.

II. Pharmacotherapy Decision-Making –

A. Pursue the role of drug therapy practitioner over that of drug therapy advisor.

B. Participate in pharmacotherapy decision-making by:

i. Identifying opportunities for decision-making.
ii. Proactively engaging decision-making opportunities.
iii. Formulating decision rationale that is the result of rigorous inquiry, scientific reasoning, and evidence.
iv. Pursuing the highest levels of decision-making.
v. Seeking independence in making decisions and accepting personal responsibility for the outcomes to patients resulting from one's decisions.
vi. Personally enacting decisions

2. DRUG INDUCED DISEASES

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

4. ONLINE PHARMACEUTICAL CARE SERVICES AND GLOBALIZATION.

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

PHARM 623 PHARMACY PRACTICE-IX (ClinicalPharmacy-II) [Lab.]
Cr. Hr.: 01 Marks: 50

4. 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.
5. Students will also complete a report independently or in a group on a Drug Use Evaluation
6. Students will take the assignment tasks to enhance verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects

Recommended Books

1. Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Levingstone, London, 4th Ed., 2003.

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

PHARM 624 PHARMACEUTICS-X (Industrial Pharmacy-II) [Th.]
Cr. Hr.: 03 Marks: 100

01. EMULSIONS: Mechanical Equipments, Specific formulation Considerations and Emulsion stability.

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

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

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

05. STERILE PRODUCTS: Sterile area and its Classification, Ophthalmic ointments, Preparation of praenterals (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.).

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

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

09. SAFETY METHODS IN PHARMACEUTICAL INDUSTRY:

(a) Mechanical, chemical and fire hazards problems.
(b) Inflammable gases and dusts.

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

PHARM 625 PHARMACEUTICS-X (Industrial Pharmacy-II) [Lab.]
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. Manufacture of Tablets by Wet Granulation Method, by Slugging and by Direct Compression. Coating of Tablets (Sugar Coating, Film coatingand Enteric Coating). Clarification of liquids by various processes. Size Reduction. Homogenization. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables. Capsule filling by semi automatic machines. Manufacture of sustained action drugs. Tablets Tests like Disintegration. Dissolution. Friability. Hardness and thickness tests. Determination of weight variation in tablets. Density of powder. Particle size analysis.

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

Recommended Books:

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

PHARM 626 PHARMACEUTICS-XI (Biopharmaceutics-II) [Th.]
Cr. Hr.: 03 Marks: 100

1. 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

2. ELIMINATION OF DRUGS:
   a) 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.
   b) Renal Excretion of Drugs: Renal clearance, Tubular Secretion and Tubular Reabsorption.
   c) Elimination of Drugs through other organs: Pulmonary excretion, Salivary excretion, Mammilary excretion, Skin excretion and Genital excretion.

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

4. 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.
5. PHARMACOKINETICS OF INTRAVENOUS INFUSIONS.
6. BIOPHARMACEUTICAL ASPECTS IN DEVELOPING A DOSAGE FORM
   Drug considerations, drug product considerations, patient considerations, manufacturing considerations, pharmacodynamic considerations pharmacokinetic considerations
7. *IN-VITRO-IN-VIVO* CORRELATION (*IVIVC*)
   Introduction, levels and determination of in-vitro/in-vivo correlation

PHARM 627 PHARMACEUTICS-XI (Biopharmaceutics-II) [Lab.]
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. 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. In humans. Renal excretion of drugs or drug disposition.

Recommended Books:

1. Leon Shargel, Applied Pharmacokinetics and Biopharmaceutics, Appleton & Lange, New York, 5th Ed., 2008.
2. Malcoln Rouland, Thomous N Tozer, Clinical Pharmacokinetics, William &

Willkins, London, 1995.
3. Milo Gibaldi, Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Marchel & Dakker Inc, New York, 2008.
4. Gibbson and Skett, Introduction to Drug Metabolism, 3rd Ed, Champ & Hall, London, 2001.
5. Robert E Notari, Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Marchel & Dakker Inc, New York, 1988.
6. Sarfraz Niazi, Text Book of Biopharmaceutics & Clinical Pharmacokinetics. Appleton-Century-Crofts, New York, 1985.
7. Gul Majid Khan, Biopharmaceutics: Text Book for Pharmacy Students & Working Pharmacists *[ISBN978-969-9101-00-7]*
8. Gul Majid Khan, Text Book of Biopharmaceutics & Pharmacokinetics for Post Graduate Students
9. Gul Majid Khan, Laboratory Manual of Biopharmaceutics & Pharmacokinetics *[ISBN 978-969-9101-02-1]*
10. Stephen H Curry, Drug disposition and pharmacokinetics, Black Well Scientific Publishing, Oxford, 1983.
11. Avraham Yacobi, Toxicokinetics and New Drug Development, Paramount Press, New York, 1989.
12. P Macheras, C Reppas and J B Dressman, Biopharmaceutics of orally
13. administered drugs, Ellis Horwood Limited, London (1995).
14. Albert P Li, *In vitro* approaches for evaluation of drug efficacy and toxicity, CRC Press LLC USA, 2004.
15. Ronald D Schoenwald, Pharmacokinetics in drug discovery and Development, CRC Press LLC, USA, 2002.

PHARM 628 PHARMACEUTICS-XII (Pharmaceutical Quality Management-II) [Th.]
Cr. Hr.: 03 Marks: 100

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, 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.

PHARM 629 PHARMACEUTICS-XII (Pharmaceutical Quality Management-II) [Lab.]
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. 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 practical will be performed)

Recommended Books:

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

FINAL PROFESSIONAL

FIRST SEMESTER

PHARM 710 PHARMACEUTICS-XIII (Pharmaceutical Technology-I) [Th.]
Cr. Hr.: 03 Marks: 100

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

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

4. Polymers used in drug delivery systems

5. Novel Drug Delivery System (DDS)
   a) Sustained/ Controlled Release Drug Delivery System
      i) Microencapsulation technique
         - Coacervation
         - Solvent evaporation
         - Interfacial polymerization
         - Spray drying
         - Etc.
      ii) Developmental aspects of Matrix and Reservoir Systems

PHARM 711 PHARMACEUTICS-XIII (Pharmaceutical Technology-I) [Lab.]
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 requirements, e.g. Various techniques to develop the formulation, Granulation technology, Study of drug delivery systems, Biotechnological aspect of product development, In-vitro Quality Control of various dosage forms. Microbial assay, Particle size analysis using various methods, Stability studies of Pharmaceuticals, Coating of particles and To prepare, examine and control specifications of packaging materials.

Recommended Books

1. Anya M. Hellery, Drug delivery and targeting, 13th Ed, Taylor & Francis, London, 2001.
2. Joseph R Robinson Controlled drug delivery, Marcel & Dakker Inc, New York, 2nd Ed., 1992.
3. T V Ramabhadran, Pharmaceutical design and development, Ellis Horwood, New York, 1994.
4. M E Aulton, Pharmaceutics: Science of Dosage Forms Design, ELBS/Churchill Livingstone, London, 1998.
5. Banker, Modern pharmaceutics, Marchell Dakker Inc, New York, 2002.
6. John A Bontempo, Development of biopharmaceutical parenteral dosage forms, Marchell Dakker Inc, New York, 1997.

7. N K Jain, Controlled and Novel drug delivery, CBS Publishers & Distributers, New Delhi, 2004.
8. Ansel, Pharmaceutical Dosage Form in Drug Delivery System, Lee & Febiger, London,2004.
9. Attaurahman and M I Chaudry, Bioassay techniques for drug development, CRC Press, LLC, USA, 2001.

PHARM 712 PHARMACY PRACTICE-X (Clinical Pharmacy-III) [Th.]
Cr. Hr.: 03 Marks: 100

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.

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

4. DRUG ABUSE & MISUSE.

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

PHARM 713 PHARMACY PRACTICE-X (ClinicalPharmacy-III) [Lab.]
Cr. Hr.: 01 Marks: 50

- 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.
- Student are required to take/present verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects

Recommended Books:

1. Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Levingstone, London, 4th, 2003.
2. Guard Paul, A Behavioral Approach to Pharmacy Practice, Black Well, USA, 2000.
3. Herfindal Gourley, Clinical Pharmacy & Therapeutics, 4th Ed, William & Willkins, London, 1992.
4. A J Winfield, Pharmaceutical Practice, Churchill Levingstone, London, 3rd Ed., 2003.
5. Kavin Taylor, Pharmacy Practice, 2nd Ed Taylor & Francis, New York, 2003.
6. Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 4th edition, Sarrison, Inc, North Carolina, USA. 2001.

7. Simon Cook, Clinical Studies Management, a Practical Guide to Success, Sue Horwood Publishing limited, West Sussex, and UK.2004.
8. Joseph T Dipiro, Encyclopedia of Clinical Pharmacy. Marcel Dekker Publishing, 2003.
9. Joseph T Dipiro, Encyclopedia of Pharmacy. Marcel Dekker Publishing, 2002.
10. Mellainie J Rantucci, Pharmacist Talking with Patients, 2nd Ed, 1997.
11. Smith GDG and Aronson J K, Oxford Text Book of Clinical Pharmacology and Drug Therapy, Oxford University Press, UK, 1990.
12. Hansten P and Horn J, Drug interactions. Lee & Febiger, Philadelphia, USA, 1989.

PHARM 714 PHARMACY PRACTICE-XI (Forensic Pharmacy-I) [Th.]
Cr. Hr.: 03 Marks: 100

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:

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

PHARM 716 PHARMACY PRACTICE -XII (Pharmaceutical Management & Marketing-I) [Th.]
Cr. Hr.: 03 Marks: 100

1. MANAGEMENT:
   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

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

Recommended Books:

1. M Ahmad & N I Bukhari, Pharmaceutical Management and Marketing, Tariq Academy, Faslabad-Pakistan, (2002).
2. C Patrick Tharp & Pedro J Lecca, Pharmacy Management for students and practitioners, The C V Mosby Company, St. Louis, Toronto, London, (1979).
3. Harry A Smith, Principles & Methods of Pharmacy Management, Lea & Febiger, Philadelphia, 1986.
4. Herta A. Murphy, Herbert W. Hildebrandt, Jeans P. Thomas, Effective Business Communication, 8th Edition, 2009

PHARM 718 PHARMACEUTICAL CHEMISTRY-V (Medicinal Chemistry-I) [Th.]
Cr. Hr.: 03 Marks: 100

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

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

2. DRUG TARGETS AND DRUG DESIGNING:
   i. Introduction and types of Drug targets
   ii. Introduction to Molecular modeling and computational chemistry
   iii. Structure based designing

iv. Ligand-based designing
v. Various techniques in drug synthesis.

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

a. Hormones: Steroidal Hormones (Testosterone, Progesterone, Estrogen, Aldosteron and Cortisol), Proteinous Hormones (Insulin, Glucagon, Oxytocin and Vassopressin).
b. Anti-neoplastic Agents: Tamoxifen, Fluorouracil, Mercapturine, Methotrexate and Vincristine.
c. Sedatives, & Hypnotics: Benzodiazepines, Barbiturates, Paraldehyde, Glutethimide, Chloral hydrate, and alcohols.
d. 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).
e. Analgesics and Antipyretics: Paracetamol, Salicylic acid analogues, Quinolines derivatives, Pyrazolone and Pyrazolodiones, N - arylanthranilic acids, Aryl and heteroaryl acetic acid derivatives.

PHARM 719 PHARMACEUTICAL CHEMISTRY-V (Medicinal Chemistry-I) [Lab.]
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. Estimation of functional groups; Carboxylic, Hydroxy, Amino and Nitro groups; Determination of Molecular weights of Organic Compounds. Synthesis of Paracetamol, Salicylic Acid, Methyl salicylate, Azobenzene, Benzoic Acid, 5-Hydroxy-1, 3-benzoxazol-2-one, Aspirin, P-nitrosophenol, 3-nitrophthalic acid, o-Chloro-benzoic acid. Assay of the Drugs like Sulpha drugs, Aspirin, Paracetamol, Benzyl Penicillin. Inorganic Preparations.
(Note: A minimum of 10 practicals will be conducted)

Recommended Books

1. Martin and Cook, Remington Practice of Pharmaceutical Science, 12th Ed, Mack Publishing Company, USA, 2001
2. Foye W O, Principles of Medicinal Chemistry, 6th Ed, Verghese Publising House, Bomby, 2008.
3. Tyagi, Textbook of Synthetic Drugs, Anmol Publications, Delhi, 1990.
4. Alferd Burger, Medicinal Chemistry, 6th Ed, Jhon Willey & Sons, New York, 2003.
5. Block, Roche, Soine and Wilson, Inorganic and Medicinal Pharmaceutical Chemistry, Verghese Publishing House, Bombay, 1986.
6. Block, Roche, Soine and Wilson. Inorganic and Medicinal Pharmaceutical Chemistry, Lee & Febiger, Philadelphia, USA, 1983.

SECOND SEMESTER

PHARM 720 PHARMACEUTICS-XIV (Pharmaceutical Technology-II) [Th.]
Cr. Hr.: 03 Marks: 100

1. Novel GIT Drug Delivery System
    - Oral Osmotic Pumps
    - Ion-Exchange Controlled DDS
    - pH – Controlled DDS
    - Bio/mucoadhesive DDS
    - Floating DDS
2. Drug Carrier System
    - Liposomes
    - Niosomes
3. Targeted Drug Delivery System
    - Active Drug Delivery System
    - 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

PHARM 721 PHARMACEUTICS-XIV (Pharmaceutical Technology-II) [Lab.]
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 requirements, e.g. Various techniques to develop the formulation, Granulation technology, Study of drug delivery systems, Biotechnological aspect of product development, In-vitro Quality Control of various dosage forms. Microbial assay, Particle size analysis using various methods, Stability studies of Pharmaceuticals, Coating of particles and To prepare, examine and control specifications of packaging materials.

Recommended Books:

1. Anya M. Hellery, Drug delivery and targeting, 13th Ed, Taylor & Francis, London, 2001.

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

PHARM 722 PHARMACY PRACTICE-XIII (Clinical Pharmacy-IV) [Th.]
Cr. Hr.: 03 Marks: 100

1. PHARMACEUTICAL CARE, ITS SCOPE, MANAGEMENT AND APPLICATION OF CARE PLAN

2. CLINICAL THERAPEUTICS:
   (a) General Strategy: Terminology of Disease. Management and Treatment. Drug Selection.
   (b) Basic introduction of some clinical situations, their clinical features, etiology, pathophysiology and treatment of causes: Common Cold, Pharyngitis and Tonsillitis, Pneumonia, Tuberculosis, Diarrhea (Amoebic & Bacillary Dysentery, Giardiasis) Malaria, Meningitis, Tetanus, Typhoid Fever, Measles, Rabies, AIDS, Congestive cardiac failure, Conjunctivitis, Anemia, Gout, Asthma, Ulcer, Diabetes mellitus, Hypertension, Hepatitis, Dermatology (Scabies, Fungal diseases), Dengue fever.

3. 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.

4. SAFE INTRAVENOUS THERAPY & HAZARDS OF IV THERAPY

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

PHARM 723 PHARMACY PRACTICE-XIII (Clinical Pharmacy-IV) [Lab.]
Cr. Hr.: 01 Marks: 50

- 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.
- Student are required to take/present verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects

Recommended Books:

1. Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Levingstone, London, 4th, 2003.
2. Guard Paul, A Behavioral Approach to Pharmacy Practice, Black Well, USA, 2000.
3. Herfindal Gourley, Clinical Pharmacy & Therapeutics, 4th Ed, William & Willkins, London, 1992.
4. A J Winfield, Pharmaceutical Practice, Churchill Levingstone, London, 3rd Ed., 2003.
5. Kavin Taylor, Pharmacy Practice, 2nd Ed Taylor & Francis, New York, 2003.
6. Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 4th edition, Sarrison, Inc, North Carolina, USA. 2001.
7. Simon Cook, Clinical Studies Management, a Practical Guide to Success, Sue Horwood Publishing limited, West Sussex, and UK.2004.
8. Joseph T Dipiro, Encyclopedia of Clinical Pharmacy. Marcel Dekker Publishing, 2003.
9. Joseph T Dipiro, Encyclopedia of Pharmacy. Marcel Dekker Publishing, 2002.
10. Mellainie J Rantucci, Pharmacist Talking with Patients, 2nd Ed, 1997.
11. Smith GDG and Aronson J K, Oxford Text Book of Clinical Pharmacology and Drug Therapy, Oxford University Press, UK, 1990.
12. Hansten P and Horn J, Drug interactions. Lee & Febiger, Philadelphia, USA, 1989.
13. Pramod K Gupta, Inject able drug development, CRC Press, LLC, USA, 1999.
14. H John Smith, Introduction to the principals of drug design and action, 4th Ed, CRC Press, LLC, USA, 2005.
15. Rong Liu, Water Insoluble Drug Formulations, 2nd Ed, CRC Press, LLC, USA, 2008.
16. Peter Blaisdell, Twenty First Century Pharmaceutical Development. CRC Press, LLC, USA, 2000.
17. Lachman, Theory and Practice of Industrial Pharmacy, 3rd Ed, Verghese Publishing House, Bombay, 2009.

PHARM 724 PHARMACY PRACTICE-XIV (Forensic Pharmacy-II) [Th.]
Cr. Hr.: 03 Marks: 100

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 FACTORY LAW 1934.

5. SHOPS AND ESTABLISHMENT ORDINANCE, 1969 WITH RULES.

Recommended Books:

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

PHAM 726 PHARMACY PRACTICE-XV (Pharmaceutical Management & Marketing-II) [Th.]

Cr. Hr.: 03 Marks: 100

1. MARKETING MANAGEMENT: 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:

1. M Ahmad & N I Bukhari, Pharmaceutical Management and Marketing, Tariq Academy, Faslabad-Pakistan, (2002).
2. C Patrick Tharp & Pedro J Lecca, Pharmacy Management for students and practitioners, The C V Mosby Company, St.

Louis, Toronto, London, (1979).
3. Harry A Smith, Principles & Methods of Pharmacy Management, Lea & Febiger, Philadelphia, 1986.
4. Herta A. Murphy, Herbert W. Hildebrandt, Jeans P. Thomas, Effective Business Communication, 8th Edition, 2009

PHARM 728 PHARMACEUTICAL CHEMISTRY-VI (Medicinal Chemistry-II) [Th.]

Cr. Hr.: 03 (Marks: 100)

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

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

i. Sulphonamides: Prontosil, sulphanilamide, Sulphapyridine, sulphadimidine, Sulfamethoxazole, Sulfadiazine and Sulfafurazole.
ii. Antimalarials: 4-Aminoquinolines, 8-Aminoquinolines, 9-Amino acridines, Biguanides, Pyrimidine analogues, Mefloquine and Cinchoha alkaloids.
iii. Diuretics: Mercaptomerin, Meralluride, Thiazides, Sprironolac-tone, Theophylline, Furosemide, Acetazolamide, Ethacrynic acid and Triameterene.
iv. Antitubercular Drugs: Ethambutol, Isonicotinic acid, Hydrazid, Rifampacin, Thioguanine, Pyrazinamide, cycloserine, Ethunamide, Cytarabine, 5-Flourouracil and Dacarbazine.
v. Antiviral Drugs: Acyclovir, Tromantadine Hydrochloride and Ribavirin.
vi. Immunosuppressant Agents: Azathioprine and Cyclosporin.
vii. Antibiotics: Penicillins, Cephalosporins, Streptomycin, Chloramphenicol, Tetracyclines, Kanamycin and Erythromycin.

PHARM 729 PHARMACEUTICAL CHEMISTRY-VI (Medicinal Chemistry-II) [Lab.]

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

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

Recommended Books:

1. Martin and Cook, Remington Practice of Pharmaceutical Science, 12th Ed, Mack Publishing Company, USA, 2001
2. Foye W O, Principles of Medicinal Chemistry, 6th Ed, Verghese Publising House, Bomby, 2008.
3. Tyagi, Textbook of Synthetic Drugs, Anmol Publications, Delhi, 1990.
4. Alferd Burger, Medicinal Chemistry, 6th Ed, Jhon Willey & Sons, New York, 2003.
5. Block, Roche, Soine and Wilson, Inorganic and Medicinal Pharmaceutical Chemistry, Verghese Publishing House, Bombay, 1986.
6. Block, Roche, Soine and Wilson. Inorganic and Medicinal Pharmaceutical Chemistry, Lee & Febiger, Philadelphia, USA, 1983.

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, 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. After passing the Pharmacy examination and completing 1 year of residency, graduates are eligible to register with the Pharmacy Council and may practice as a registered pharmacist in Pakistan.

FACULTY OF PHARMACY

The faculty will comprise of the following departments with relevant subjects

1. Department of Pharmaceutics

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

2. Department of Pharmaceutical Chemistry

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

3. Department of Pharmacognosy

- Pharmacognosy-I
- Pharmacognosy-II

4. Department of Pharmacology

- Physiology
- Anatomy & Histology
- Pathology
- Pharmacology -I
- Pharmacology -II

5. Department of Pharmacy Practice

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

PHARM-D FIVE-YEAR COURSE

SCHEME OF STUDIES FOR ANNUAL SYSTEM

First Professional

(Theory)

Paper 1	Pharmaceutical Chemistry-I (Organic)	100
Paper 2	Pharmaceutical Chemistry-II	100
Paper 3	Pharmaceutics-I (Physical Pharmacy)	100
Paper 4	Physiology	100
Paper 5	Anatomy & Histology	50
Paper 6	Pharmacy Practice-I (Pharmaceutical Mathematics and Biostatistics)	100
Paper 7	English	100
(Practical)		
Paper 8	Pharmaceutical Chemistry-I (organic)	100
Paper 9	Pharmaceutical Chemistry-II	100
Paper 10	Pharmaceutics-I (Physical Pharmacy)	100

Paper 11	Physiology	100
Paper 12	Anatomy & Histology	50
	Total Marks:	1100

Second Professional

(Theory)

Paper 1	Pharmaceutics-II (Dosage Form	100
Paper 2	Pharmacology -I	100
Paper 3	Pharmacognosy-I (Basic)	100
Paper 4	Pharmaceutics-III (Microbiology & Immunology)	100
Paper 5	Pakistan Studies and Islamic Studies	100
	(Practical)	
Paper 6	Pharmaceutics-II (Dosage Form	100
Paper 7	Pharmacology -I	100
Paper 8	Pharmacognosy-I (Basic)	100
Paper 9	Pharmaceutics-III (Microbiology & Immunology)	100
	Total Marks:	900

Third Professional

(Theory)

Paper 1	Pathology	50
Paper 2	Pharmacology -II	100
Paper 3	Pharmacognosy-II (Advanced)	100
Paper 4	Pharmacy Practice-II (Dispensing, Community and Social & Administrative	100
Paper 5	Pharmaceutical Chemistry-III	100
	(Practical)	
Paper 6	Pathology	50
Paper 7	Pharmacology –II	100
Paper 8	Pharmacognosy-II (Advanced)	100
Paper 9	Pharmacy Practice-II (Dispensing, Community and Social & Administrative	100
Paper 10	Pharmaceutical Chemistry-III (Pharmaceutical Analysis)	100
	Total Marks:	900

Fourth Professional

(Theory)

Paper 1	Pharmacy Practice-III (Hospital	50
Paper 2	Pharmacy Practice -IV (Clinical	100
Paper 3	Pharmaceutics-IV (Industrial Pharmacy)	100
Paper 4	Pharmaceutics-V (Biopharamceutics)	100
Paper 5	Pharmaceutics-VI (Pharmaceutical	
	(Practical)	
Paper 6	Pharmacy Practice -IV (Clinical	50
Paper 7	Pharmaceutics-IV (Industrial Pharmacy)	100
Paper 8	Pharmaceutics-V (Biopharamceutics)	100
Paper 9	Pharmaceutics-VI (Pharmaceutical	
	Total Marks:	900

Fifth Professional

(Theory)

Paper 1	Pharmaceutical Chemistry-IV (Medicinal	100
Paper 2	Pharmacy Practice -V (Advanced	100
Paper 3	Pharmaceutics-VII (Pharmaceutical	100
Paper 4	Pharmacy Practice -VI (Forensic	100
Paper 5	Pharmacy Practice-VII (Pharmaceutical	100
Paper 6	Pharmacy Practice -VIII (Computer and its Applications in Pharmacy)	50
	(Practicals)	
Paper 7	Pharmaceutical Chemistry-IV (Medicinal	100
Paper 8	Pharmacy Practice -V (Advanced	100
Paper 9	Pharmaceutics-VII (Pharmaceutical	100
Paper 10	Pharmacy Practice -VIII (Computer and its Applications in Pharmacy)	50
	Total Marks:	900

Grand Total Marks: 4700

DETAILS OF COURSES (ANNUAL SYSTEM)

FIRST PROFESSIONAL

PHARMACEUTICAL CHEMISTRY-I (ORGANIC) WRITTEN

Paper 1 100 Marks

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

1. BASIC CONCEPTS: Conjugation, hyperconjugation, steric effect, inductive effect, mesomeric effect, hydrogen bonding, Theory of resonance. Effect of structure on reactivity of compounds. Tautamerism of carbonyl compounds.

2. NUCLEOPHILIC AND ELECTROPHILIC SUBSTITUTION REACTION IN ALIPHATIC AND AROMATIC SYSTEMS.

3. ORIENTATION IN ELECTROPHILIC SUBSTITUTION REACTIONS ON BENZENE RING.

4. STUDY OF INDIVIDUAL REACTIONS AND REARRANGEMENTS

   a) Arndt Eister reaction, Baeyer-Villiger oxidation; Diels Alder reaction; Grignard's reaction, Metal hydride reduction, Wolf Krishner reduction, Friedel Craft's reaction, Mannich Reaction and Condensation reaction

   b) Pinacol-pinacolone Rearrangement, Hofmann and Beckmann rearrangement, Claisen Rearrangement and Benzilic Acid Rearrangement

5. STEREOCHEMISTRY: Stereoisomerism, optical isomerism; Molecules with more than one chiral centre. Geometrical isomerism, Resolution of racemic mixture, Conformational analysis.

6. FREE RADICALS: Introduction, structure and stability, preparation and properties.

7. GENERAL METHODS OF PREPARATIONS, PROPERTIES, IDENTIFICATION TEST AND PHARMACEUTICAL APPLICATIONS OF THE FOLLOWING CLASSES AND THEIR ANALOGUES: Alcohols, Phenols, Ethers, Aldehydes, Ketones, Acids, esters, Amines.

8. PREPARATION AND PROPERTIES OF MEDICINALLY IMPORTANT HETEROCYCLIC COMPOUNDS such as: Pyrrol, Furan, Thiophene, Pyridine

9. PREPARATION AND PROPERTIES OF HETEROCYCLIC COMPOUNDS in which benzo-ring is fused with five and six member ring containing one heteroatom; Indole, Quinoline and Isoquinoline.

PHARMACEUTICAL CHEMISTRY-I (ORGANIC) PRACTICAL

Paper 8 (100 Marks)

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.

1. Organic analysis: Identification of unknown simple organic compounds.

2. Organic Preparations: Benzoic acid, Aspirin, Acetanilide, Iodoform, Nitrophenol, 3-nitrophthalic acid, Benzhydrol and 2,4-Dinitro-chlorobenzene.

Recommended Books

1. Peter Sykes, A guide Book to Mechanism in Organic Chemistry, Longman, New York, 6th Ed, 1991.
2. E L Eliel, Stereochemistry of Carbon Compounds, Tata McGraw- Hill, New Delhi, 1992.
3. Rehman and M Younis, Organic Chemistry for B.Sc. students, Ilmi Kitab Khana, Lahore, 1997.
4. L Finar, Organic Chemistry Vol I, Person Education Asia, 6th Ed., New Delhi, 2001.
5. Raj K Bansel, Organic Reaction Mechanism, Tata McGraw-Hill, New Delhi, 1992.
6. Furaiss Brian, Practical Organic Chemistry, 5th Ed.,

   ELBS, London.
7. Sykes A P, Guide Book to Mechanism in Organic Chemistry, 6th Ed., Lonsmen Co, UK, 2008.
8. Roberts J D and Caserio M C, Basic Principles of organic Chemistry, 1990.
9. Naser-ud-Din, Introduction to Stereochemistry, Ghafoor Stationery Mart, Peshawar, 1994.
10. Bhal B S, Textbook of Organic Chemistry, S Chand & Co, New Delhi, 16th Ed., 2007.
11. L.G. Wade, Organic Chemistry, Prentice Hall, New York, U.S.A., 7th Ed., 2010.

PHARMACEUTICAL CHEMISTRY-II (BIOCHEMISTRY) (WRITTEN)

Paper 2 100 Marks

1. GENERAL INTRODUCTION AND BASIC BIOCHEMICAL PRINCIPLES

Role of pharmaceutical Biochemistry in the health Profession. Nature of Biochemical reactions

2. BASIC CHEMISTRY OF BIOMOLECULES (Nature, Classification etc.)

a) Carbohydrates: Chemistry, Classification, Reactions of Carbohydrates, Optical

activity, Biological and pharmaceutical importance of carbohydrates.

b) Lipids: Chemistry of Fatty acids and Lipids, Classification (Saponifiable and non-

saponifiable lipids, Simple, Complex and derived lipids), Reactions of Fatty acids and other Lipids, Essential fatty acids, Biological and pharmaceutical importance of lipids.

c) Proteins and Amino acids: Chemistry, Classification of proteins and amino acids,

Reactions of proteins and amino acids, Organizational levels, Macromolecular nature of proteins, Biological and pharmaceutical importance of proteins and amino acids.

d) Nucleic acids: Chemistry, Types (DNA, RNA, mRNA, tRNA, rRNA), Purine and

Pyrimidine bases, Nucelosides, Nucelotides, Structures of nucleic acids, Biological and pharmaceutical importance of nucleic acids.

e) Vitamins: Chemistry, Classification (Fat-soluble and water-soluble vitamins),

Biological and pharmaceutical importance of vitamins.

f) Hormones: Chemistry, Classification (Proteinous and nonproteinous hormones,

amino acid derivatives, steroids), Biological and pharmaceutical importance of hormones.

g) Enzymes: Chemistry, Classification, Mode of action, Kinetics (Michaelis Menten

Equation and some modifications), Inhibition, Activation, Specificity, Allosteric enzymes, Factors affecting the rate of an enzyme-catalyzed reaction, Biological and pharmaceutical importance, Mechanism of action of some important enzymes (Chymotrypsin, Ribonuclease).

3. METABOLIC FATE OF BIOMOLECULES (Anabolism and Catabolism)

a. Carbohydrates: Introduction to metabolism, 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 b-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.

4. 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.

5. 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-II (BIOCHEMISTRY) (PRACTICAL)

Paper 9 100 Marks

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

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

Recommended Books:

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

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

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

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

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

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

7. M Rafiq, Biochemistry, The Carvan Book House, Lahore, 1st Ed.

8. Montogomary, Clinical Chemistry, the C V Mosby Company, 5th Ed.

9. Conn and Stumpf, Outlines of Biochemistry, John Willey & Sons, New York, 5th Ed., 1999.

10. Lehninger, Principles of Biochemistry, 4th Ed Worth Publishers Co, New York. 2004

11. Ahmed M Essentials of Medical Biochemistry, Merit Pub Fasilabad, 1991.

12.West E S, Todd R W and Van Bruggen T J, Text Book of Biochemistry, The MacMillan Co, 1996.

PHARMACEUTICS-I (PHYSICAL PHARMACY) (WRITTEN)

Paper 3 (100 Marks)

1. PHARMACY ORIENTATION:

Introduction and orientation to the Professional 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: Solubility, factors affecting solubility, surfactants, their properties and types. Micelles, their formulation and types.

c. Ionization, pH, pH indicators, pka, buffers, buffer's equation, Isotonic solutions and their applications in pharmacy.

d. Hydrolysis, types and protection of drugs against hydrolysis.

e. Micromeritics: Particle size and shapes, distribution of particles methods of determination of particle size and importance of particle size in Pharmacy.

4. DISPERSIONS:

a. Colloids: Types, methods of preparation, properties (optional, kinetic, electrical) Dialysis and artificial kidney, stability of colloids, protection and sensitization phenomenon and application of colloids in Pharmacy.

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

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

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

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

6. PHYSICOCHEMICAL PROCESSES:

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

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

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

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

7. RATE AND ORDER OF REACTIONS.

8. KINETIC PRINCIPLES AND STABILITY TESTING: THEORETIC CONSIDERATIONS: (Degradation):

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

   b. Chemical Factors: Complex chemical reactions. Oxidation-reduction, hydrolysis

PHARMACEUTICS-I (PHYSICAL PHARMACY) PRACTICAL

Paper 10 (100 Marks)

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.

1. Experiments to demonstrate some of physico-chemical processes like simple distillation, steam distillation, crystallization, Dialysis.
2. Determination of Emulsion systems.
3. Determination of particle size.
4. Density, Specific Volume, Weights and Volumes of Liquids.
5. Preparation of Buffer solutions and isotonic solution.

6. Determination of %age composition of solutions by specific gravity method.

7. Partition-coefficient, surface tension, viscosity.

Recommended Books:

1. Martin, Physical Pharmacy, B I Waverly PVT, Delhi, 5th Ed., 2005.

2. Cooper and Gunns Tutorial Pharmacy, 6th Ed, CBS Publishers & Distributors, New Delhi, 2005.

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

4. Martin P, Bustamante P and Chun, Physical & Chemical Principles of Pharmaceutical Science, AHC, 6th Ed., (1999), New York.

5. Martin AMN, Banker G S and Chun AHC Advances in Pharmaceutical Sciences. Vol 7, Academic Press, London, 1995.

6. Mill C C Casson,N. Rheology of disperse systems. Pergamon Press, New York, 1975.

7. Rienger M and Scott-Blair. G W Rheology. Academic Press, London, 1990.

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

9. Sherman P Emulsion Science, Academic Press, London, 1972. 1 0.Martin A, Swarbrick J and Cammatra A

10. Physical Pharmacy, 3rd Ed., Lee & Febiger, Philadelphia. 1983.

11 Attwood D and Flocence A T Surfactant Systems.Chapman and Hall Ltd, London, 1982.

PHYSIOLOGY (WRITTEN)

Paper 4 (100 Marks)

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, Multi-enzyme 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 Massagers, 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 Phenomena, 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, type 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.

3. 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 Lunge.

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 Grain or Loss, Buffering o 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, Anatomy, 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 (PRACTICAL)

Paper 11 (100 Marks)

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.

4. EYE: Visual activity, far vision, near vision and Field of vision (Perimetry).

5. CENTRAL NERVOUS SYSTEM: Nerve Muscle Preparation in frog, Effect of Temperature on muscle and Demonstration of spinal reflexes.

Recommended Books:

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

ANATOMY & HISTOLOGY (WRITTEN)

Paper 5 (50 Marks)

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. Organcelles. Nucleus. Cell cycle.

3. TISSUE OF BODY: Types of tissues with examples

   a. Epithelial Tissue: General characters, classification.

   b. Connective Tissue: Structure, types (Connective tissue Cartilage. Bones structure and types of bones and joints). Muscle:

   c. Structure of — skeletal muscle, Smooth muscle, muscle.

4. INTEGUMENTARY SYSTEM:

(a) Skin — Structure (Epidermis, dermis).

(b) Glands of Skin, (Sweat, Sebaceous).

(c) Hair — Structure, function.

(d) Nail.

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. ELEMENTARY SYSTEM: Name and structure of different parts of elementary 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 — Mid-Brain. 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).

HISTOLOGY (WRITTEN):

(a) Underlying principles of histological techniques and staining specific tissues should be explained.

(b) Staining of paraffin and frozen sections will be given to the students.

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

ANATOMY & HISTOLOGY (PRACTICAL)

Paper 12 (50 Marks)

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.

1. Demonstration of the Preparation and staining of slides

2. Histological examination of slides: Epithelium, Muscle tissue and Connective tissue.

3. Organ system — Lung, Kidney, Stomach, Appendix, Skin, Intestine and Gall bladder.

Recommended Books (Anatomy)

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

8. R J Last, Anatomy, Regional and Applied, 11th Ed, J and A Churchill Ltd, London. 2001.

Histology

1. Bradbury S, Hewer's Textbook of Histology, ELBS, London, 1984.

2. Reference Book: Tissues of the body by Legros Clerks. Publisher Oxford at the Clarendon Press, London.

3. Cormack H D, Essential Histology, 2nd Ed, J B Lippincott Co, Philadelphia, 1993.

4. Hammersen F, Histology; color atlas of microscopic anatomy, 3rd Ed, Lee & Febijer Co, Pennsylvania, 1985.

PHARMACY PRACTICE-I (MATHEMATICS AND BIOSTATISTICS) (WRITTEN)

Paper 6 (100 Marks)

Part A: (Pharmaceutical Mathematic) (40 marks)

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 Ellips.

Part B: BIOSTATISTICS (60 MARKS)

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

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

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

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

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

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

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

8. STUDENT “t”, “F” and Chi-Square Distributions: Test of Significance based on “t” , “F” and Chi-Square Distributions.

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

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

Recommended Books (Pharmaceutical Mathematics & Biostatistics)

1. C H Edvards. Jr. and David E Penney, Calculus and Analytic Geometry, Prentice-Hall, Inc, A division of Sinon & Schustor Englewood Gliffs, New Jersey 07632, USA. 1995.
2. Daniel W W Bio-Statistics, Foundation for Analysis in Health Science. 9th Ed, 2008.
3. Zar J H, Biostatistical analysis, 4th Ed, Francis Hall, NJ, U.S.A. 1999.
4. Nilton, J S and Tsokos, J D, Statistical Methods in Biological and health Sciences, McGrew-Hill. 1983.
5. Chaudhry S A and Kmal S, Introduction to Statistical Theory, Part-I and Part-II, Ilmi Kitab Khana, Urdu Bazar, Lahore. 1996.
6. Samuels M, Statistics for the life sciences,3rd Ed, Dellen Pub Co SF, USA. Introduction to Statistics, Macmillam Pub Co, NY.2002.
7. Ahmed B and Khan M, Mathematics for Pharmacists, Arsalan Paper Mart, Multan, 1993.

English Compulsory (Written)

Paper 7 (Marks 100)

Part: A, (Functional English)

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: To be improved by showing documentaries/films carefully selected by subject teachers

Translation skills: Urdu to English

Paragraph writing : Topics to be chosen at the discretion of the teacher

Presentation skills: Introduction

Part: B, (Communications Skills)

Objectives: Enable the students to meet their real life communication needs.

Course Contents:

Paragraph writing; Practice in writing a good, unified and coherent paragraph

Essay writing: Introduction CV and job applicationTranslation skills; Urdu to English

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

Academic skills; Letter/memo writing, minutes of meetings, use of library and internetPresentation skills: Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

Part: C, (Technical Writing and Presentation Skills)

Objectives: Enhance language skills and develop critical thinking

Course Contents

Presentation skills;

Essay writing; Descriptive, narrative, discursive, argumentative

Academic writing; How to write a proposal for research paper/term paper, (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Note: Extensive reading is required for vocabulary building

Recommended books:

A. Functional English

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492

2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

b) Writing

Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

c) Reading/Comprehension

Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

d) Speaking

B: Communication Skills

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

b) Writing

1. Writing. Intermediate by Marie-Chrisitine Boutin, Suzanne Brinand

and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).

2. Writing. Upper-Intermediate by Rob Nolasco. Oxford

Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

c) Reading

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.

2. Reading and Study Skills by John Langan

3. Study Skills by Riachard Yorky.

d) Technical Writing and Presentation Skills

a) Essay Writing and Academic Writing

1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).

2. College Writing Skills by John Langan. Mc=Graw-Hill Higher Education. 2004.

3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.

C: Presentation Skills

1. Reading

The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editiors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

ECOND PROFESSIONALS
PHARMACEUTICS-II (DOSAGE FORMS SCIENCE) WRITTEN

Paper 1 (100 Marks)

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. Ingredients, Product formulation.

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

4. EXTRACTION PROCESSES: Maceration: Purpose and process. Percolation: Purpose and Process. Liquid-Liquid extraction. Large scale extraction.

5. SOLVENTS USED IN PHARMACEUTICAL PREPARATIONS.

6. ORAL SOLUTIONS, SYRUPS, ELIXIRS AND SPIRITS: Solutions and their preparation, dry mixtures for solution, oral rehydrate solutions, oral colonic leverage solution. Syrup: components and preparation of Syrups. Elixirs: Preparation of elixirs, medicated and non-medicated elixirs.

7. ORAL SUSPENSIONS, EMULSIONS, MAGMA AND GELS: Preparations, Examples, and Importance.

8. 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.

9. 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.

10. SUPPOSITORIES AND VAGINAL SUPPOSITORIES: Semi-solid Preparations, Suppositories bases, preparation, packaging and storage, Solutions/Enemas.

11. AEROSOLS, INHALATIONS AND SPRAYS: Aerosol: Principle, container and valve assembly, Propellants, filling, testing, packaging, labeling and storage.

12. 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, their types, characteristics and methods of preparation.

13. INTRODUCTION TO PARENTERALS: Official types of injections, solvents

and vehicles for injections, added substances.

14. A BRIEF INTRODUCTION TO ORAL HYGIENE PRODUCTS.

PHARMACEUTICS-II(PREPARATIONS) (PRACTICAL)

Paper 6 (100 Marks)

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

(A minimum of twenty practical will be conducted)

Recommended Books

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

PHARMACOLOGY -I (WRITTEN)

Paper 2 (100 Marks)

1. GENERAL PHARMACOLOGY

(a) Pharmacology: Definition, History, and its various branches.

Drug: Definition and its various sources.

(b) Routes of drugs 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 (t1/2β) Bioavailability and various factors affecting it. Dose, Efficacy and potency of drugs. Hypersensitivity and Idiosyncratic reactions, drug tolerance and dependence. Drug interactions. Plasma protein binding.

(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 noncompetitive), 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 agonist drugs: Catecholamines and Noncatecholamines.

d. Sympathetic antagonist drugs: Adrenergic receptor Blockers and neuron blockers.

e. Parasympathetic (Cholinergic) agonists and Anticholinestrase inhibitors.

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 ulcer: Antacids, H2-Receptor antagonists,

antimuscarinic agents, proton pump inhibitors, prostaglandin agonists, gastrin receptor antagonist and cytoprotective agents.
e. Drug treatment of chronic inflammatory bowel diseases.
f. Drugs affecting bile flow and Cholelithiasis

4. AUTACOIDS AND THEIR ANTAGONISTS: Histamine and Anti-histamines, Serotonin and Serotonin Antagonists and other Autocoids.

5. DRUGS ACTING ON RESPIRATORY SYSTEM:

a. Drugs used for cough (Anti-tussives, Expectorants and Mucolytic Agents).

b. Drugs used for Bronchial Asthma (Bronchodilators, Cromoglycate, Nedocromil, Cortecosteroids & other Anti-inflammatory drugs and Muscarinic receptor antagonists)

6. DRUGS ACTING ON CARDIO-VESCULAR SYSTEM:

a. Angina pectorus and its drug treatment
b. Congestive heart failure & its treatment Anti-arrhythmic drugs
c. Agents used in Hyperlipidemia
d. Coagulants and Anti-coagulants
e. Anti-hypertensives
f. Diuretics

7. DRUGS ACTING ON GENITOURINARY SYSTEM: Oxytoxic drugs, Ergot alkaloids and uterine relaxants

8. ANTI-ANAEMIC DRUGS:

9. HORMONES, ANTAGONISTS AND OTHER AGENTS AFFECTING ENDOCRINE FUNCTION: Endocrine function and dys functions.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 -I (PRACTICAL)

Paper 7 (100 Marks)

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. Introduction to instruments such as Organ Bath, Kymograph, Oscilograph polygraph Patch Clamp Technique and Power Lab. Preparation of standard solution. Ringer solution. Tyrode solution. Kreb 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 demonstate the effects of vasconstrictor 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 20 practicals will be conducted)

Recommended Books

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

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

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

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

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

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

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

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

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

10. Prof Dr A Qayum, Fundamentals of Experimental Pharmacology.

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

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

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

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

PHARMACOGNOSY-I (WRITTEN)

Paper 3 (100 Marks)

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

2. Crude Drugs
   Crude drugs, commerce, preparation, chemical and therapeutic classifications of crude drugs; official and un-official drugs. The Study of the crude drugs belonging to various families of medicinal importance.

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

3. Evaluation and Adulteration of Crude Drugs
   Organoleptic study, physical evaluation, microscopic evaluation, types of adulteration, inferiority, spoilage, admixture, sophistication and substitution of crude drugs.

4. Drugs of Animal Origin
   General introduction and discussion about honey, gelatin, shellac, musk, civet, ambergris, cod liver oil, cantharides and spermaceti.

5. Biologics

Sources, structure, preparation, description and uses of vaccines, toxins, antitoxins, venoms, antivenins, antiserums.

6. 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

7. Pesticides
   Introduction, methods and control of pests with special reference to pyrethrum, tobacco, and other natural pesticides

8. Growth Regulators

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

9. 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

10. Enzymes

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

PHARMACOGNOSY-I (PRACTICALS)

Paper 8 (100 Marks)

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. Physicochemical and Microscopic testing of Surgical dressings.

(Note: A minimum of 20 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:

Reference Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York (1955-1977).

2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers (2000).
3. Ayurvedic Pharmacognosy,Partab Chauhan, Ed., Sonali Publications, New Delhi (2007).
4. Baker B.M. and Bender D.A. Vitamins in Medicine, Vol. 1-2 (1980-82)
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York (2000).
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York (1981).
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart (1994).
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, (2005).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester (1997).

10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa (2003).
11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad (2003).
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London (2007).
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia (2001).
14. Poisonous Plants of all Countries, A Bernard Smith, 2nd ed., Peridical Expert Book (1988).
15. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, (1988).
16. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, (2005).
17. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester (1999).
18. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol (1975).
19. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher (2009).
20. Tyler V.E., Brady E.R. and Robbers J.E. Pharmacognosy, 9th ed., Lea & Febiger, Philadelphia (1988).

PHARMACEUTICS-III (MICROBIOLOGY & IMMUNOLOGY) (WRITTEN)

Paper 4 (100 Marks)

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. ORGANISMS: 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.

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

3. THE FUNGI/YEAST/MOLDS.

4. THE PROTOZOA.

5. THE NORMAL FLORA: Microbiology of air, water and soil (general introduction and normal inhibitants of air, water, and soil).

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

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

8. FACTORY AND HOSPITAL HYGIENE AND GOOD MANUFACT-URING PRACTICE:

   Introduction, Control of Microbial contamination during manufacture, Mnaufacture of Sterile products, A Guide to Current Good Pharmaceutical Manufacturing Practices.

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

PHARMACEUTICS-III (MICROBIOLOGY & IMMUNOLOGY) (Practical)

Paper 9 3 (100 Marks)

NOTE:- Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Sterilization of Glassware and pharmaceutical products by various methods. Microbiological assays of: Anti-biotics and vitamins. Preparation of general and selective media and culturing of microorganisms. Total and viable counts of micro-organism. Morphological and selective biochemical characterization of some specimen. Staining of Bacteria: Gram method, Acid fast, Giemasas staining, Capsule staining, Flagella staining and Spore staining. Microbiological analysis of air, water and soil. (Note: A minimum of 20 practicals will be conducted)

Recommended Books

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

PAKISTAN STUDIES AND ISLAMIYAT (Comp.) WRITTEN

Paper 5 (100 Marks)

Part: A, Pakistan Studies (Compulsory) 40 marks

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, 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

Books Recommended:

1. Burki, Shahid Javed. *State & Society in Pakistan,* The Macmillan Press Ltd 1980.

2. Akbar, S. Zaidi. *Issue in Pakistan's Economy.* Karachi: Oxford University Press, 2000.

3. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.

4. Mehmood, Safdar. *Pakistan Political Roots & Development.* Lahore, 1994.

5. Wilcox, Wayne.*The Emergence of Banglades.,* Washington: American Enterprise, Institute of Public Policy Research, 1972.

6. Mehmood, Safdar. *Pakistan Kayyun Toota,* Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.

7. Amin, Tahir. *Ethno - National Movement in Pakistan,* Islamabad: Institute of Policy Studies, Islamabad.

8. Ziring, Lawrence. *Enigma of Political Development.* Kent England: WmDawson & sons Ltd, 1980.

9. Zahid, Ansar. *History & Culture of Sindh.* Karachi: Royal Book Company, 1980.

10. Afzal, M. Rafique. *Political Parties in Pakistan,* Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.

11. Sayeed, Khalid Bin. *The Political System of Pakistan.* Boston: Houghton Mifflin, 1967.

12. Aziz, K.K. *Party, Politics in Pakistan,* Islamabad: National Commission on Historical and Cultural Research, 1976.

13. Muhammad Waseem, Pakistan Under Martial Law, Lahore: Vanguard, 1987.

14. Haq, Noor ul. *Making of Pakistan: The Military Perspective.* Islamabad: National Commission on Historical and Cultural Research, 1993.

Part: B, ISLAMIC STUDIES 60 marks

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.

Introduction to Quranic Studies

1) Basic Concepts of Quran
2) History of Quran
3) Uloom-ul –Quran

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)

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)

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 in Makkah

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 in Madina

3) Important Lessons Derived from the life of Holy Prophet in Madina

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

Selected Study from Text of Hadith

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

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

Islam & Science

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

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

Political System of Islam

1) Basic Concepts of Islamic Political System

2) Islamic Concept of Sovereignty

3) Basic Institutions of Govt. in Islam

Islamic History

1) Period of Khlaft-E-Rashida

2) Period of Ummayyads

3) Period of Abbasids

Social System of Islam

1) Basic Concepts of Social System of Islam

2) Elements of Family

3) Ethical Values of Islam

Reference Books:

1) Hameed ullah Muhammad, "Emergence of Islam" , IRI, Islamabad
2) Hameed ullah Muhammad, "Muslim Conduct of State"

3) Hameed ullah Muhammad, 'Introduction to Islam

4) Mulana Muhammad Yousaf Islahi,"

5) Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.

6) Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)

7) Mir Waliullah, "Muslim Jrisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)

8) H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep

Publications New Delhi (1989)

9) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

THIRD PROFESSIONAL
PATHOLOGY (WRITTEN)

Paper 1 50 Marks

1. SCOPE OF PATHOLOGY & CONCEPT OF DISEASES.

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

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

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

PATHOLOGY (Practical)

Paper 6 (50 Marks)

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, Sq. Cell Carcinoma, Basal Cell Carcinoma, Transitional Cell Carcinoma, Adenocarcinoma, Fibrocarcinoma, Rhadomyo sarcoma, Leomyo sarcoma, Lymphosarcoma, Liposarcoma, Reticular Cell Sarcoma, Hodgkins disease, Breast Carcinoma, Osteogenic Sarcoma, Osteoclastoma, Hapatitis, Diabetes.

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.

Tests for various Specimens of Clinical Importance

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

Recommended Books

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

   New York, 1996

PHARMACOLOGY -II (WRITTEN)

Paper 2 (100 Marks)

Objectives: On completion of this course student should:

1. know the aetiology of disease,
2. be able to classify the drugs used for its treatment.
3. Understand the mechanism of drug action
4. Be able to describe pharmacokinetics, indication, contraindication, dose and dosage, adverse effects, cautions and pre-cautions and their interaction with other drugs and food.

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) Opioids 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 antirheumatic drugs, non- opioids analgesics and drugs used in the treatment of gout.

3. CHEMOTHERAPY

- Basic principles of chemotherapy
- 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,
- Anti-fungals
- Anti-virals, anti-protozoals (anti- malarias, anti-amebiasis,, anthelmintics and anti leishmanials) and antimycobacterial drugs.
- Anti-neoplastic drugs,

5. IMMUNOPHARMACOLOGY: Pharmacology of immune-suppressants and stimulants

6. TOXICOLOGY

(a) Pollution and its typers (water, air, food)

(b) Poison and principle of treatment of poisoning.

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

(d) Chelating agents and their role in poisoning: Dimercaprol, Calcium disodiumedentate, Pencillamine and Defroxamine.

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 -II (PRACTICAL)

Paper 7 (100 Marks)

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. To study the convulsant effects of strychnine and picrotoxin in frogs and to determine the site of action. To identify the unknown (convulsant) drug and determine its site of action. To study the effects of Adrenaline on Human Eyes. To study the effects of Pilocarpine on Human Eyes. To study the effect of Homatropine on Human Eyes. To identify and observe the effects of unknown drugs on Human Eyes. To study the effects of local anaesthetic drugs on human and the nerve plexus of frog. To identify and differentiate the effects of unknown drug on human and the nerve plexus of frog. To demonstrate the effects of Acetylcholine on the Rectus abdominus muscle of frog and competitive pharmacological antagonism by Neuromuscular blocking agent e.g. Gallamine. To identify the unknown drug by performing pharmacological competitive antagonism on Rectus abdominus muscle of Frog. To study the anti-coagulant effects of Heparin and oral anti-coagulants on Rabbits. To identify the unknown anticoagulant drug using Rabbits. To demonstrate the graded Dose-Response curve of Acetylcholine on Rabbit intestine. To identify unknown concentration of Acetycholine from graded Dose-Response curves. To demonstrate the general anesthetic effect on rabbits. To demonstrate the effect of sedatives and hypnotics on rabbits. To demonstrate the anti-nociceptive (nalagesic) effect on mice. To demonstrate antidepressant effect in rats (forced swimming test, tail suspension test Yohimbin lethality test).

(Note: A minimum of 20 practicals should be conducted)

Recommended Books

1. Goodman Gilman, Pharmacological basis of therapeutics. 11th Ed, McGraw-Hill Book Company, New York, 2008.
2. Winguard and Brody, Human Pharmacology, Mosby Year Book, Boston, 1991.
3. James M Ritter and Lionel De Levis, A Text book of Clinical Pharmacology, 5th Ed, Oxford University Press, New York, 2008.
4. R S Satorkar and S D Bhandarkar, Pharmacology and Pharmaco-therapeutics, Popular Prakashan, Bomby, 1998.
5. J D Tripathy, Essential of Medical Pharmacology, Japees Brother, New Delhi, 6th Ed, 2008.
6. D R Laurance, Clinical Pharmacology, ELBS, London, 8th Ed., 1998.
7. Katzung B G, Basic and Clinical Pharmacology, McGraw-Hill Medical Publishers, New York, 11th Ed., 2009.
8. Lippincott, Pharmacology, 4th Ed, Lippincott Williams & Wilkins, USA, 2008.
9. Manuchair Edabi, Pharmacology, Little Brown & Company, London, 1993.
10. Prof Dr A Qayum, Fundamentals of Experimental Pharmacology.
11. Bertram G K, Basic and Clinical Pharmacology, Paramount Publishing Business & Professional Group, USA, 6th Ed., 1995.
12. William F Ganong, W F, Review of Medical physiology, 22nd Ed, 2005 Prentice Hall International Inc, New Jersey.
13. Qayum A, Fundamentals of Experimental Pharmacology. Ghandhara University, Peshawar, 2004.
14. Pharmacology by Ran & Dell, 6th edition.

PHARMACOGNOSY-II (ADVANCED) (WRITTEN)

Paper 3 (100 Marks)

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, infra-red, mass, nuclear magnetic resonance (^{1}H-NMR and ^{13}C-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, Cassification, 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) Steroidal 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) Anthroquinone glycosides: Cascara, Aloe, Rhubarb, Cochineal and Senna.

(c) Saponin glycosides: Glycyrrhiza, Sarsaparilla.

(d) Cyanophore glycosides: Wild cherry.

(e) Isothiocyanate glycosides: Black Mustard.

(f) Lactone glycosides: Cantharide.

(g) Aldehyde glycosides: Vanilla.

(h) Miscellaneous glycosides: Gentian, Quassia, Dioscorea.

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

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

   (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.

7. 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.

8. Resins and Oleoresins

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

9. Tannins

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

10. Natural Toxicants

a) General Introduction to Plant Toxicology
Definition, clasificatand 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, cyanognic), Alkaloids (imidazole, pyrrolizidine, tropane).

c) Lower Plant Toxins
Bacterial toxins *(Staphylococcus aureus, Clostridium botulinum),* Algal toxins *(Microcystis aeruginosa,* Cyanobecteria, *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*.*

11. An introduction to Nutraceuticals and Cosmeceuticals

12. Tumor Inhibitors from Plants
    Introduction of anticancer agents of natural origin, as *Catharanthus roseus*, *Colchicum autumnale*, *Podophyllum peltatum*, rifamycin antibiotics, macrolide antibiotics, anti-AIDS agents and immunostimulants.

13. Introduction to Clinical Pharmacognosy
    General introduction and historical background of clinical Pharmacognosy. Study of treatment by herbal medicines.

14. Clinical Use of Herbs & Herbal Medicine

Diabetes:	*Gymnema sylvestre, Melia azadirchta, Momordica charantia, 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-II (ADVANCED) (PRACTICAL)

Paper 8 (100 Marks)

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 20 practicals will be conducted)

Recommended Books:

1. Alkaloids, Manske R.H.F. Vol. V-XVI, Academic Press, New York (1955-1977).
2. Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, Betty P. Jackson, CBS Publishers (2000).
3. Ayurvedic Pharmacognosy,Partab Chauhan, Ed., Sonali Publications, New Delhi (2007).
4. Baker B.M. and Bender D.A. Vitamins in Medicine, Vol. 1-2 (1980-82)
5. Biologically Active Natural Products: Pharmaceuticals, Horace G. Cutler, Eds., Illustrated Edition, CRC Press Publisher, New York (2000).
6. Biosynthesis of Natural Products, Mannito P., John Wiley & Sons, New York (1981).
7. Herbal Drugs and Phytopharmaceuticals, Nornam G. Bisset, Ed., Medpharm Scientific Publishers, Stuttgart (1994).
8. Herbs and Natural Supplements: An evidence-Based guide, Lesley Braun, Marc Cohen, Elsevier Mosby, London, (2005).
9. Medicinal Natural Products: A Biosynthetic Approach, Paul M Dewick, 1st ed., John Wiley & Sons, Ltd., Chichester (1997).
10. Medicinal Plants of the World, Vol. I, II, III, Ivan A Ross, 2nd ed., Humana Press, Totowa (2003).

11. Monographs of Unani Medicine, Vol. I, BAIT AL Hikmah, Hamdard Foundation Pakistan, DC and TMD, National Institute of Health, Islamabad (2003).
12. Nutraceuticals: A Guide for Healthcare Professionals, Brain Lockwood, Lisa Rapport, Pharmaceutical Press, London (2007).
13. Pharmacognosy, Varro E. Tyler, Lynn R. Brady, James E. Robbers, 10th ed., Lea and Febiger, Philadelphia (2001).
14. Poisonous Plants of all Countries, A Bernard Smith, 2nd ed., Peridical Expert Book (1988).
15. Poisonous Plants of All Countries, Arthur-Bernhard Smith, 2nd ed., Periodical Expert Book, Delhi, (1988).
16. Poisonous Plants: A Hand Book for doctors, Pharmacists, Toxicologists and Veterinarians, Dietrich Forhne, Han J Pfander, Manson Publishing, London, (2005).
17. The Hand book of Natural Flavonoids, Vol. 1-2 by Jeffery B. Harborne & Herbert Baxter, Eds., John Willey & Son, Chiester (1999).
18. The Practical Evaluation of Phytopharmaceuticals, K. R. Brain, T.D. Turner, Wright-Scientechnica, Bristol (1975).
19. Trease and Evans' Pharmacognosy, William C. Evans, George E. Trease, Daphne Evans, 16th ed., Illustrated Elsevier Health Sciences Division Publisher (2009).
20. Tyler V.E., Brady E.R. and Robbers J.E. Pharmacognosy, 9th ed., Lea & Febiger, Philadelphia (1988).

PHARMACY PRACTICE II (DISPENSING, COMMUNITY, SOCIAL & ADMINISTRATIVE PHARMACY (WRITTEN)

Paper 4 100 Marks (40+60)

PART 'A' DISPENSING (40 Marks)

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.

PART 'B'

COMMUNITY, SOCIAL & ADMINISTRATIVE PHARMACY (60 Marks)

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 Utilisation 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 and interpretation. Background, philosophy and use of complementary and alternative therapies including herbal medicines, homeopathy, acupuncture, acupressure, Bach Flower Remedies, aromatherapy and reflexology.

9. 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.

PHARMACY PRACTICE -II (DISPENSING, COMMUNITY AND SOCIAL & ADMINISTRATIVE PHARMACY) (PRACTICAL)

Paper 9 (100 Marks)

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

Practical introduction to prescription-handling, interpretation, filling and Labeling.

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

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

Incompatibility: Practical Importance of Incompatibilities

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

Cosmetics: Lipstick, talcum powder, after shave lotion, shaving cream.

(Note: A minimum of 20 practicals will be conducted).

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

Recommended Books:

1. Cooper and Guns, Dispensing, CBS Publishers & Distributors, New Delhi, 1986.
2. J. W. Cooper, Colin Gunn, S. J. Carter, Cooper and Gunn's dispensing for pharmaceutical students Churchill Livingstone, 1987
3. John F. Marriott, Pharmaceutical compounding and dispensing Pharmaceutical Press, 2006
4. Roy Robertson, Management of Drug Users in the Community: A practical Handbook, 1998.
5. Remington’s Pharmaceutical Sciences, Mack Publishing Company, USA, 2001
6. Martindale's Extra Pharmacopeia, 2009.
7. William T. O'Donohue, Eric R. Levensky, Promotingtreatment adherence:

   a practical handbook for health care providers; Sage Publications, 2006
8. Shane P. Desselle, David P. Zgarrick, Pharmacy management: essentials for all practice settings - McGraw-Hill Professional, 2004.
9. Richard N. Spivey, Albert I. Wertheimer, T. Donald Rucker, International pharmaceutical services: Routledge, 1992

PHARMACEUTICAL CHEMISTRY-III (Pharmaceutical Analysis) (WRITTEN)

Paper 5 (100 Marks)

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

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 and GC-MS, Capillary Electrophoresis.

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

4. THERMAL ANALYSIS

   Differential Scanning Calorimetry, Differential Thermal Analysis, Thermo Gravimetric Analysis

5. OCCURANCE, 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.

6. TITRIMETRIC ANALYSIS

a) Acid-base titration, Oxidation-reduction, Argentometric titration, Complexometric titration and Non-aquous titration etc.
b) Statistical analysis of data

PHARMACEUTICAL CHEMISTRY-III (INSTRUMENTATION) (PRACTICAL)

Paper 10 (100 Marks)

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. Determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques.

(Note: A minimum of 20 practicals will be conducted)

Recommended Books

1. Lough W J, High Performance Liquid Chromatography, Blacki Academic Press, New York, 1996.
2. William Kemp, Organic Spectroscopy, 3rd Ed, Ellsi Horwood, London, 2008.
3. M Aminuddin & Javed Iqbal, Theory and Practice of

   Chromatography, (2000).
4. A H Beckett and J B Stennlake, Practical Pharmaceutical Chemistry, 4th Ed, Part I and II, the Aulton Press, London. 2001.
5. A M Knevel and F E Digangi, Jenkin's quantitative Pharmaceutical Chemistry, 7th Ed, McGraw-Hill Book company, New York.1977.
6. A Braithwaite and F J Smith, Chromatographic Methods, 5th Ed, Chapman and Hall, London. 1995.
7. E Heftmann, Chromatography, 6th Ed, Von Nostrond Reinheld Co, New York, 2004.
8. A Pryde and M J Gilbert, Applications of High Performance Liquid Chromatography, Chapman & Hall, London, 1979.
9. E Stahl, Thin Layer Chromatography, 2nd Ed, Springer-Verlag, Berlin, 1969.

10. R Hamilton, Introduction to HPLC, P A Sewell, Chapman & Hall, London, 1982.

FOURTH PROFESSIONAL

PHARMACY PRACTICE-III HOSPITAL PHARMACY (WRITTEN)

Paper-1 (100 Marks)

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 etc.
   - 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

11. MANUFACTURING BULK AND STERILE.

12. THE PHARMACY — CENTRAL STERILE SUPPLY ROOM

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

14. ROLE OF PHARMACIST IN SMALL HOSPITALS, NURSING HOMES ETC.

15. 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.

16. NUCLEAR PHARMACY.

17. THE PHYSICAL PLANT AND ITS EQUIPMENT.

18. INVESTIGATIONAL USE OF DRUGS.

19. HEALTH ACCESSORIES.

20. SURGICAL SUPPLIES.

21. INSPECTION OF WARDS WITH REFERENCE TO DRUG STORAGE AND ADMINISTRATION.
22. MANAGEMENT OF ACCIDENT & EMERGENCY PHARMACY (A & E).

Recommended Books

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

PHARMACY PRACTICE-IV (CLINICAL PHARMACY-I) (WRITTEN)

Paper 2 (100 Marks)

1. GENERAL INTRODUCTION TO CLINICAL PHARMACY: Terminologies, Basic Components and Scope.

2. PATIENT PROFILE & PATIENT COUNSELING:

    a. Patient disease profile

    b. Taking case History

    c. Drug Profile of 25 Drugs (Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cepahlosporins, Chlorpheniramine, Cimetidine, Digoxin, Dobutamine, Dopamine, Fluroquinolone, Frusemide, Lactulose, Macrolides, Metoclopramide, Morphine/Pethedine, Nifedipine, NSAIDS, ORS, Penicillins, Prednisolone, Salbutamol, Vancomycin)

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.

5. DRUG INTERACTIONS: Mechanism, Physiological factors affecting interaction, Types and level of drug interactions, Role of pharmacist in evaluating drug interactions & 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, General toxicity, Toxicity following drug withdrawal, Detection, Management of ADR, reporting of ADR in light of international health monitoring system.

7. PHARMACOTHERAPY PLAN

I. Develop, Implement, and Monitor Drug Therapy Plans

A. Establish desired therapeutic outcomes.

B. Consider drug and non-drug therapy alternatives.

C. Develop drug therapy plans that are patient-specific, comprehensive, logical, practical, consider current evidence-based medicine recommendations, include strategies for prevention, and include patient education.

D. Establish a plan for therapeutic drug monitoring that includes accurate documentation of population and patient-specific parameters, dosing history/administration times, monitoring parameters, and daily SOAP notes/plans.

E. Develop and implement the pharmacotherapeutic

plan promptly, efficiently, accurately, and effectively.

F. Use an effective patient monitoring system

(monitoring forms).

G. Monitor the patient and follow up at appropriate intervals.

H. Revise drug therapy plans on an ongoing basis.

I. Ensure continuity of pharmaceutical care to and from the acute and ambulatory care patient care settings.

II. Pharmacotherapy Decision-Making –

A. Pursue the role of drug therapy practitioner over that of drug therapy advisor.

B. Participate in pharmacotherapy decision-making by:

i. Identifying opportunities for decision-making.

ii. Proactively engaging decision-making opportunities.

iii. Formulating decision rationale that is the result of rigorous inquiry, scientific reasoning, and evidence.

iv. Pursuing the highest levels of decision-making.

v. Seeking independence in making decisions and accepting personal responsibility for the outcomes to patients resulting from one's decisions.

vi. Personally enacting decisions

8. DRUG INDUCED DISEASES

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

10. ONLINE PHARMACEUTICAL CARE SERVICES AND GLOBALIZATION.

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

PHARMACY PRACTICE-IV (CLINICAL PHARMACY-I) (PRACTICAL)

Paper 6 (100 Marks)

7. 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.

8. Students will also complete a report independently or in a group on a Drug Use Evaluation

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

Recommended Books

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

12. Hansten P and Horn J, Drug interactions. Lee & Febiger, Philadelphia, USA, 1989.

PHARMACEUTICS-IV (INDUSTRIAL PHARMACY) WRITTEN

Paper 3 (100 Marks)

1. MASS TRANSFER.

2. HEAT TRANSFER.

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

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

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

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

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

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

9. SAFETY METHODS IN PHARMACEUTICAL INDUSTRY:

   (a) Mechanical, chemical and fire hazards problems.

   (b) Inflammable gases and dusts.

10. EMULSIONS: Mechanical Equipments, Specific formulation Considerations and Emulsion stability.

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

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

13. STERILE PRODUCTS: Sterile area and its Classification, Ophthalmic ointments, Preparation of praenterals (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.).

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

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

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

PHARMACEUTICS-IV (INDUSTRIAL PHARMACY) (PRACTICAL)

Paper 7 (100 Marks)

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

(Note: A minimum of 20 practicals will be conducted)

Recommended Books

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

PHARMACEUTICS –V (BIOPHARMACEUTICS) (WRITTEN)

Paper 4 (100 Marks)

1. DEFINITIONS AND TERMINOLOGY: Biopharmaceutics, Generic Equivalence, Bioavailability, Bioequivalence, Drug Disposition, Therapeutics, Pharmacokinetics; LADMER (Liberation, absorption, distribution, Metabolism, elimination and Response) System; and Therapeutic Equivalents.
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 HALFLIFE 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. BIOAVAILABILITY AND BIOEQUIVALENCE

a. Introduction.
b. Bioavailability types, parameters, significance and study protocol.
c. Methods of Assessment of Bioavailability
d. Bioequivalence study designs, components and application, report format

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.
Statistical Moment Theory; MRT for various compartment models; Physiological Pharmacokinetic model.

8. 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

9. ELIMINATION OF DRUGS:
a) 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.

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

c) Elimination of Drugs through other organs: Pulmonary excretion, Salivary excretion, Mammilary excretion, Skin excretion and Genital excretion.

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

11. 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.

12. PHARMACOKINETICS OF INTRAVENOUS INFUSIONS.

13. BIOPHARMACEUTICAL ASPECTS IN DEVELOPING A DOSAGE FORM

    Drug considerations, drug product considerations, patient considerations, manufacturing considerations, pharmacodynamic considerations pharmacokinetic considerations

14. IN-VITRO-IN-VIVO CORRELATION (IVIVC)

    Introduction, levels and determination of in-vitro/in-vivo correlation

PHARMACEUTICS –V (BIOPHARMACEUTICS) (PRACTICAL

Paper 8 (100 Marks)

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. In humans. Renal excretion of drugs or drug disposition.

Recommended Books

1. Leon Shargel, Applied Pharmacokinetics and Biopharmaceutics, Appleton & Lange, New York, 5th Ed., 2008.
2. Malcoln Rouland, Thomous N Tozer, Clinical Pharmacokinetics, William & Willkins, London, 1995.
3. Milo Gibaldi, Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Marchel & Dakker Inc, New York, 2008.
4. Gibbson and Skett, Introduction to Drug Metabolism, 3rd Ed, Champ & Hall, London, 2001.
5. Robert E Notari, Biopharmaceutics and Clinical Pharmacokinetics, 4th Ed, Marchel & Dakker Inc, New York, 1988.
6. Sarfraz Niazi, Text Book of Biopharmaceutics & Clinical

Pharmacokinetics. Appleton-Century-Crofts, New York, 1985.

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

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

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

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

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

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

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

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

PHARMACEUTICS-VI (PHARMACEUTICAL QUALITY MANAGEMENT) (WRITTEN)

Paper 5 (100 Marks)

1. INTRODUCTION:

Basic concepts about introduction of pharmaceutical industry in relevance to quality control departments, testing, quality management system, quality assurance, Good Manufacturing Practices and Current Good Manufacturing Practices.

General understanding of good laboratory practices and validation

2. QUALITY CONTROL OF SOLID DOSAGE FORMS (conventional and modified release dosage forms:

(a) Physical tests: Hardness, Thickness and Diameter, Friability,

Disintegration, Weight Variation.

(b) Chemical tests: Content uniformity, Assay of active ingredients.

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 ingredients.

4. QUALITY CONTROL OF SUPPOSITORIES: Disintegration test, Uniformity of weight, Assay of active ingredients, 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 ingredients.

6. 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.

7. 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.

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

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

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

11. STATISTICAL INTERPRETATION OF QUALITY CONTROL CHARTS DURING MANUFACTURING PROCESSES.

PHARMACEUTICS-VI (PHARMACEUTICAL QUALITY MANAGEMENT) (PRACTICAL)

Paper 9 (100 Marks)

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 20 practicals will be performed)

Recommended Books

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

FINAL PROFESSIONAL

PHARMACEUTICAL CHEMISTRY-IV (MEDICINAL CHEMISTRY) (WRITTEN)

Paper 1 (100 Marks)

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

1. INTRODUCTION TO MEDICINAL CHEMISTRY:

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

2. DRUG TARGETS AND DRUG DESIGNING:

i. Introduction and types of Drug targets
ii. Introduction to Molecular modeling and computational chemistry
iii. Structure based designing
iv. Ligand-based designing
v. Various techniques in drug synthesis

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

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

(b) Anti-neoplastic Agents: Tamoxifen, Fluorouracil, Mercapturine, Methotrexate and Vincristine.

(c) Sedatives and Hypnotics: Benzodiazepines, Barbiturates, Paraldehyde, Glutethimide, Chloral hydrate, and alcohols.

(d) 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).

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

(f) Sulphonamides: Prontosil,sulphanilamide,Sulphapyridine, sulphadimidine, Sulfamethoxazole, Sulfadiazine and Sulfafurazole.

(g) Antimalarials: 4-Aminoquinolines, 8-Aminoquinolines, 9-Amino acridines,

Biguanides, Pyrimidine analogues, Mefloquine and Cinchoha alkaloids.

(h) Diuretics: Mercaptomerin, Meralluride, Thiazides, Sprironolac-tone, Theophylline, Furosemide, Acetazolamiode, Ethacrynic acid and Triameterene.

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

(j) Antiviral Drugs: Acyclovir, Tromantadine Hydrochloride and Ribavirin.

(k) Immunosuppressant Agents: Azathioprine and Cyclosporin.

4. ANTIBIOTICS:

Penicillins, Cephalosporins, Streptomycin, Chloramphenicol, Tetracyclines, Kanamycin and Erythromycin.

PHARMACEUTICAL CHEMISTRY-IV (MEDICINAL CHEMISTRY) (PRACTICAL)

Paper 7 (100 Marks)

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 20 practicals will be conducted)

Recommended Books

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

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

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

Delhi, 1990.

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

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

6. Block, Roche, Soine and Wilson. Inorganic and Medicinal Pharmaceutical Chemistry, Lee & Febiger, Philadelphia, USA, 1983.

PHARMACY PRACTICE-V (CLINICAL PHARMACY-II) (WRITTEN)

Paper 2 (100 Marks)

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.

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

4. DRUG ABUSE & MISUSE.

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

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

7. CLINICAL THERAPEUTICS:

   (a) General Strategy: Terminology of Disease. Management and Treatment. Drug Selection.

   (b) Basic introduction of some clinical situations, their clinical features, etiology, pathophysiology and treatment of causes: Common Cold, Pharyngitis and Tonsillitis, Pneumonia, Tuberculosis, Diarrhea (Amoebic & Bacillary Dysentery, Giardiasis) Malaria, Meningitis, Tetanus, Typhoid Fever, Measles, Rabies, AIDS, Congestive cardiac failure, Conjunctivitis, Anemia, Gout, Asthma, Ulcer, Diabetes mellitus,

Hypertension, Hepatitis, Dermatology (Scabies, Fungal diseases), Dengue fever.

8. 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.

9. SAFE INTRAVENOUS THERAPY & HAZARDS OF IV THERAPY

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

PHARMACY PRACTICE-V CLINICAL PHARMACY-II (PRACTICAL)

Paper 8 (100 Marks)

- 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.
- Student are required to take/present verbal presentation, communication, written and problem-solving skills, critical analysis of data and provision of care through a weekly conference and projects

Recommended Books

1. Roger Walker, Clinical Pharmacy & Therapeutics, Churchill Levingstone, London, 4th, 2003.
2. Guard Paul, A Behavioral Approach to Pharmacy Practice, Black Well, USA, 2000.
3. Herfindal Gourley, Clinical Pharmacy & Therapeutics, 4th Ed, William & Willkins, London, 1992.
4. A J Winfield, Pharmaceutical Practice, Churchill Levingstone, London, 3rd Ed., 2003.
5. Kavin Taylor, Pharmacy Practice, 2nd Ed Taylor & Francis, New York, 2003.
6. Deborah Rosenbaun, Clinical Research Coordinator Hand Book, 4th edition,

Sarrison, Inc, North Carolina, USA. 2001.

7. Simon Cook, Clinical Studies Management, a Practical Guide to Success, Sue Horwood Publishing limited, West Sussex, and UK.2004.

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

9. Joseph T Dipiro, Encyclopedia of Pharmacy. Marcel Dekker Publishing, 2002.

10. Mellainie J Rantucci, Pharmacist Talking with Patients, 2nd Ed, 1997.

11. Smith GDG and Aronson J K, Oxford Text Book of Clinical Pharmacology and Drug Therapy, Oxford University Press, UK, 1990.

12. Hansten P and Horn J, Drug interactions. Lee & Febiger, Philadelphia, SA, 1989.

PHARMACEUTICS-VII (PHARMACEUTICAL TECHNOLOGY) (WRITTEN)

Paper 3 (100 Marks)

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)

   a) Sustained/ Controlled Release Drug Delivery System

      i) Microencapsulation technique

         - Coacervation
         - Solvent evaporation
         - Interfacial polymerization
         - Spray drying

ii) Developmental aspects of Matrix and Reservoir Systems

5. Novel GIT Drug Delivery System (DDS)
    - Oral Osmotic Pumps
    - Ion-Exchange Controlled DDS
    - pH – Controlled DDS
    - Bio/mucoadhesive DDS
    - Floating DDS
6. Drug Carrier System
    - Liposomes
    - Niosomes
7. Targeted Drug Delivery System
    - Active Drug Delivery System
    - Passive Drug Delivery System
8. 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

PHARMACEUTICAL TECHNOLOGY (PRACTICAL)

Paper 9 (100 Marks)

NOTE:- Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. Various techniques to develop the formulation, Granulation technology, Study of drug delivery systems, Biotechnological aspect of product development, In-vitro Quality Control of various dosage forms. Microbial assay, Particle size analysis using various methods, Stability studies of Pharmaceuticals, Coating of particles and To prepare, examine and control specifications of packaging materials.

Recommended Books

1. Anya M. Hellery, Drug delivery and targeting, 13th Ed, Taylor & Francis, London, 2001.
2. Joseph R Robinson Controlled drug delivery, Marcel & Dakker Inc, New York, 2nd Ed., 1992.
3. T V Ramabhadran, Pharmaceutical design and development, Ellis Horwood, New York, 1994.
4. M E Aulton, Pharmaceutics: Science of Dosage Forms Design, ELBS/Churchill Livingstone, London, 1998.
5. Banker, Modern pharmaceutics, Marchell Dakker Inc,

   New York, 2002.
6. John A Bontempo, Development of biopharmaceutical parenteral dosage forms, Marchell Dakker Inc, New York, 1997.
7. N K Jain, Controlled and Novel drug delivery, CBS Publishers & Distributers, New Delhi, 2004.
8. Ansel, Pharmaceutical Dosage Form in Drug Delivery System, Lee & Febiger, London,2004.
9. Attaurahman and M I Chaudry, Bioassay techniques for drug development, CRC Press, LLC, USA, 2001.
10. Pramod K Gupta, Inject able drug development, CRC Press, LLC, USA, 1999.

11 .H John Smith, Introduction to the principals of drug design and action, 4th Ed, CRC Press, LLC, USA, 2005.

12. Rong Liu, Water Insoluble Drug Formulations, 2nd Ed, CRC Press, LLC, USA, 2008.

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

14. Lachman, Theory and Practice of Industrial Pharmacy, 3rd Ed, Verghese Publishing House, Bombay, 2009.

PHARMACY PRACTICE-VI (FORENSIC PHARMACY) (WRITTEN)

Paper 4 (100 Marks)

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.

5. THE PHARMACY ACT, 1967.

6. CONTROL OF NARCOTICS SUBSTANCES ACT 1997.

Laws relating to Narcotic drugs and psychotropic substances

7. THE POISONS ACT, 1919.

8. THE FACTORY LAW 1934.

9. SHOPS AND ESTABLISHMENT ORDINANCE, 1969

WITH RULES.

Recommended Books:

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

Pharmacy Practice-VII (Pharmaceutical Management & Marketing) (written)

Paper 5 (100 Marks)

1. MANAGEMENT:

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

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

3. 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.

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

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

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

7. 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

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

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

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

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

PHARMACY PRACTICE-VIII (COMPUTER AND ITS APPLICATION IN PHARMACY) (WRITTEN)

Paper 6 (50 marks)

1. Fundamentals basic concept of computers: History of Data Processing, Types of Computers, Components of a Computer, Computer System and Business Computer System, Backing Storage Devices, Unit of Memory, Viruses and Anti-viruses Issues.

2. Research Methodologies

3. System Analysis and Design: What is a System?, Steps in system life cycle, Data Gathering and Data Analysis, Designing a New System, Development and Implementation of New System, Documentation.

4. Data Processing: Data Processing, The Data Processing Cycle, The Collection and Computing of data, Manual collection of data, The main methods of data input, Devices used to collect data, Data Verification, Data Validation, Output and Recording of data, Types of data processing systems, Types of Computer Operation, Batch Processing and Real-time Processing.

5. Application of Computers in Hospital Pharmacy: Patterns of Computer use in Hospital Pharmacy, Patient record database management, Medication order entry – Drug labels and list – Intravenous solution and admixture, patient medication profiles, Inventory control, Management report & Statistics.

6. Application of Computer in Community Pharmacy: Computerizing the Prescription Dispensing process, Use of Computers for Pharmaceutical Care in community pharmacy, Accounting and General Ledger system.

7. Application of Drug Information Retrieval & Storage : Introduction – Advantages of Computerized Literature 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-VIII (COMPUTER AND ITS APPLICATION IN PHARMACY (PRACTICAL)

Paper 10 (50 marks)

1. Internet and E-mail: Internet and Microsoft Internet Explorer 5, Addresses, Links and Downloading, Searching the Internet, E-mail and Newsgroups, Favorites, security and Customizing Explorer.

2. Web Page Development: Introduction to Front-page, Creating a First Web site, Basic Formatting Techniques, Manipulating Tables within Front-page, Front-page, Picture and Multimedia, Hyper linking, Bookmarks and Image Maps, Introducing Front-page "components", Front-page and Frames, Managing your Web, Good site design, Publishing and publicizing.

3. Data presentation skills: MS-Word, MS-Excel, MS-Power point

4. Understanding and Application of Complete Statistical Package like SPSS, Kinetica, Med Calc.

Recommended Books

1. Elias M System Analysis. Award Galgotia Publications, New Delhi, 1989.
2. Peter Norton, Inside IBM PC. Brady Computer Books, New York, 1988.
3. Dennis N, MS-DOS. Jump Practice Hall Press, New York, 1987.
4. Peter Norton, PC-DOS. Brady Computer Books, New York, 1985.

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, 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. After passing the Pharmacy examination and completing 1 year of residency, graduates are eligible to register with the Pharmacy Council and may practice as a registered pharmacist in Pakistan.

Recommendations

All members of NCRC passed unanimously the following 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. PCP and HEC will take up the matter at government level;

    i. to establish Pharmacy Services in all hospitals (public and private).
    ii. to affiliate public sector hospitals with the universities/institutions imparting Pharmacy education.
    iii. will recommended to PMDC to ensure the availability of Pharmacy services in all hospitals.

4. 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.
5. No omission and changes are allowed in the said curriculum approved by PCP and HEC, by any institution.
6. Doctor of Pharmacy degree holders will be allowed for direct admission in M.S. /M. Phil leading to PhD program.
7. The members passed a resolution that a National University of Pharmaceutical Sciences must be established on priority basis.