CURRICULUM
OF
PHARMACY
FOR
PHARM-D & M.PHIL

(Revised 2004)

HIGHER EDUCATION COMMISSION
ISLAMABAD
# CURRICULUM DIVISION, HEC

<table>
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<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Prof. Dr. Altaf Ali G. Shaikh</td>
<td>Adviser (HRD)</td>
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<tr>
<td>Qazi Riaz Ahmad</td>
<td>Director Curriculum</td>
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<tr>
<td>Malik Ghulam Abbas</td>
<td>Deputy Director</td>
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<td>Miss Ghayyur Fatima</td>
<td>Deputy Director</td>
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<tr>
<td>Mr. M. Tahir Ali Shah</td>
<td>Assistant Director</td>
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<tr>
<td>Mrs. Noshaba Awais</td>
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Composed by Mr. Zulfiqar Ali, HEC Islamabad
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PREFACE

Curriculum of a subject is said to be the throbbing pulse of a nation. By looking at the curriculum of a subject, one can judge the state of intellectual development and the state of progress of a nation. The world has turned into a global village, new ideas and information are pouring in a constant stream. It is, therefore, imperative to update our curricula by introducing the recent developments in the relevant fields of knowledge.

In exercise of the powers conferred by Sub-section (1) of section 3 of the Federal Supervision of Curricula Textbooks and Maintenance of Standards of Education Act 1976, the Federal Government vide Notification No.D773/76-JEA (Cur.), dated December 4, 1976, appointed Higher Education Commission as the Competent Authority to look after the Curriculum Revision work beyond Class XII at Bachelor level and onwards to all Degrees, Certificates and Diplomas awarded by Degree Colleges, Universities and other Institutions of higher education.

In pursuance of the above decisions and directives, the Commission is continually performing curriculum revision in collaboration with the Universities. According to the decision of the special meeting of Vice-Chancellors’ Committee, curriculum of a subject must be reviewed after every 3 years. For the purpose, various Committees are constituted at the national level comprising senior teachers nominated by the Universities. Teachers from local degree colleges and experts from user organizations, where required, are also included in these Committees.

The National Curriculum Revision Committee on Pharmacy in its meeting held in March 2004 at the HEC Regional Centre, Lahore finalized the draft curriculum after due consideration of the comments and suggestions received from the Universities and Colleges where the subject under consideration is taught.

The Final draft prepared by the National Curriculum Revision Committee duly approved by Competent Authority is being circulated for implementation by the Universities.

(PROF. DR. ALTAF ALI G. SHAIKH)

Adviser (HRD)

July 2004
CURRICULUM DEVELOPMENT

STAGE-I
CURRI. UNDER CONSIDERATION
COLLECTION OF REC
CONS. OF CRC.
PREP. OF DRAFT BY CRC
IMP. OF CURRI.
ORIENTATION COURSES

STAGE-II
CURRI. IN DRAFT STAGE
APPRAISAL OF 1ST DRAFT BY EXP. OF COL./UNIV
FINALIZATION OF DRAFT BY CRC
APPROVAL OF CURRI. BY V.C.C.
PRINTING OF CURRI.
BACK TO STAGE-I

STAGE-III
FINAL STAGE
PREP. OF FINAL CURRI.
INCORPORATION OF REC. OF V.C.C.
REVIEW

STAGE-IV
FOLLOW UP STUDY
QUESTIONNAIRE
COMMENTS

Abbreviations Used:
CRC. Curriculum Revision Committee
VCC. Vice-Chancellor’s Committee
EXP. Experts
COL. Colleges
UNI. Universities
PREP. Preparation
REC. Recommendations
INTRODUCTION

A meeting of National Curriculum Revision Committee was held on 18-20th March 2004 at HEC Regional Centre, Lahore to finalize the draft curriculum of Pharmacy prepared in Preliminary meeting in December 18-20, 2003. Following were the members of Preliminary and final National Curriculum Revision Committee meetings:-

1. Dr. Naeem A. Muzaffar  
   Dean, Faculty of Pharmacy  
   Lahore College of Pharmaceutical Sciences,  
   & Ex Chairman, Deptt. of Pharmacy, P.U.  
   Lahore  
   Convener

2. Prof. Dr. M. Jamshaid,  
   Principal, College of Pharmacy  
   University of the Punjab  
   Lahore  
   Member

3. Prof. Dr. S. Sabir Ali  
   Dean, Faculty of Pharmaceutical Sciences  
   Baqai Medical University  
   Karachi  
   Member

4. Dr. Khuda Bux Mirbahar  
   Chairman, Department of Pharmacy  
   Sindh Agriculture University  
   Tandojam  
   Member

5. Prof. Dr. Muhammad Usman Memon  
   Director, Institute of Pharmacy  
   University of Sindh  
   Jamshoro  
   Member

6. Dr. M. A. K. Malghani  
   Dean  
   Research Centre for Bio Technology & Informatics  
   Balochistan University of Information Technology & Management Sciences  
   Jinnah Town, Samungli Road  
   Member
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<tr>
<th>No.</th>
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<th>City/Location</th>
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<td>Mr. Amjad Ali Jawa</td>
<td>Managing Director</td>
<td>Wilshire Laboratories</td>
<td>Lahore</td>
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<td>124/1 Industrial Estate Kot Lakhpat</td>
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<td>8</td>
<td>Dr. Gul Majid Khan</td>
<td>Assistant Professor</td>
<td>Deptt. of Pharmacy Gomal University</td>
<td>D.I. Khan</td>
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<td>9</td>
<td>Prof. Dr. Mohammad Saeed Iqbal</td>
<td>Dean, Faculty of Pharmacy</td>
<td>University of Sargodha</td>
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<td>10</td>
<td>Dr. Khalid Hussain Janbaz</td>
<td>Chairman</td>
<td>Deptt. of Pharmacy B.Z. University</td>
<td>Multan</td>
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<td>11</td>
<td>Prof. Mrs. Ishrat Bukhari</td>
<td>Chairperson</td>
<td>Deptt. of Pharmacy University of Balochistan</td>
<td>Quetta</td>
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<td>Prof. Dr. Anwar Ejaz Baig</td>
<td>Dean</td>
<td>Faculty of Pharmacy University of Karachi</td>
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<td>13</td>
<td>Dr. G. A. Miana</td>
<td>Director</td>
<td>Ripha Institute of Pharmaceutical Sciences</td>
<td>Rawalpindi</td>
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<td>Al-Mizan-IMC, 274-Peshawar Road</td>
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<td>14</td>
<td>Mr. Tahir Mahmood Khawaja</td>
<td>Department of Pharmacy</td>
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<td>15.</td>
<td>Mr. Ayaz Ali Khan</td>
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<td>Pakistan Pharmacist Association</td>
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<td></td>
<td>5-A, Faisal Town</td>
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<td>Dr. A. Q. Khokhar</td>
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<td>Remington Pharmaceutical Industry</td>
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<td>(Nominee of Ministry of Health)</td>
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<td>18.</td>
<td>Dr. Ismat Nasreen</td>
<td>Head, Deptt. of Pharmacy</td>
<td>Lahore College for Women University</td>
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<td>19.</td>
<td>Dr. Haider Ali</td>
<td>Chairman, Deptt. of Pharmacy</td>
<td>University of Lahore</td>
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<td>20.</td>
<td>Mr. Nadeem Iqbal</td>
<td>Consultant, Medi Pak</td>
<td>799-D, Faisal Town</td>
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<td>21.</td>
<td>Prof. Dr. Abdul Qayum</td>
<td>Principal, Gandhara College of Pharmacy</td>
<td>Gandhara University</td>
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<td>22.</td>
<td>Mr. Mohammad Khurram</td>
<td>Vice-Principal</td>
<td>Gandhara College of Pharmacy</td>
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Meeting started with recitation from holy Quran by Mr. Bashir Ahmad, Deputy Director, HEC Regional Centre, Lahore.

Prof. Dr. Altaf Ali G. Shaikh, Adviser (HRD), HEC welcomed the participants on behalf of Chairman, HEC. He briefly described the procedure of curriculum development and informed the Committee that for the first time in the history of Higher Education Commission the Curriculum Division revised curricula in 87 subjects during the last three years. Dr. Altaf Shaikh said that the
main objective of curriculum is to give a minimum baseline of curriculum for the graduates of a certain subject so that uniformity and standardization of curriculum may be maintained. After this, the participants of the Committee introduced themselves. Then the session was declared open for general discussion.

National Curriculum Revision Committee in its first meeting held on December 18-20, 2003 at HEC Lahore prepared the Pharm-D 5 years programme as 1st degree in Pharmacy. Since in the United States and Canada, the Pharmacy profession is highly patient oriented, they have much more opportunities in hospital and community environment, the same is being following in Middle East market, whereas locally in Pakistan, 75% opportunities are in industrial sector. Although in Pakistan, this sector is also now reaching a level of saturation, which will result in diversion to other branches like marketing, hospital and community. Accordingly, we will have to prepare our graduates for the changing trends, especially if they aim to work globally. This can only be made possible by reviewing our pharmacy syllabi and changing the same to meet the local and global needs and requirement. Therefore, this exercise was carried out by Higher Education Commission and Pharmacy Council of Pakistan and four-year B-Pharmacy degree programme was converted into 5 years Pharm-D degree programme.

In the final meeting of National Curriculum Revision Committee was held on March 18-20, 2004 at HEC, Regional Centre, Lahore. The following points were discussed:

A. Finalization of curriculum of Pharm-D for both annual and semester system.
B. Condensed/deficiency courses required for 4 years B-Pharm graduates to get 5 years Pharm-D degree.
C. M.Phil courses after B-Pharmacy/Pharm-D (both annual and semester systems).

Following decisions were unanimously taken:

1. Keeping in view the local needs, international requirement and locally available men and material facilities, the existing 4-year B.Pharmacy course, the 1st degree in Pharmacy will be of 5 years duration and nomenclature of the degree will be Pharm-D.

2. The academic and examination system in Pharm-D will be based on Annual or Semester System.
3. The Pharm-D courses have been designed and prepared according to Annual and Semester System which will be considered as minimum standards.

4. The conversion of approved curriculum of 5 years Pharm-D programme in annual system to semester system was discussed and approved by the NCRC which should be adopted as a guideline.

5. The higher degree programme, after Pharm-D was discussed and it was decided that the duration of M.Phil after Pharm-D/B-Pharmacy will be of 2 years duration.

6. The Committee thoroughly discussed the curricula of M.Phil in the subjects of Pharmacology, Pharmaceutics, Pharmaceutical Chemistry and Pharmacognosy. These M.Phil courses are suggested in the curricula. Additional courses may also be added on the availability of expertise in the field.

7. The academic and examination system in M.Phil degree will be based on Annual or Semester System.

8. The course work in M.Phil will be in 1st Year (in Annual System) and the first 2 semesters (in semester system). The 2nd year (annual system) and 3rd & 4th semesters (Semester System) will be exclusively devoted for research thesis only.

9. It was also discussed that the M.Phil degree programme may lead to Ph.D. degree (after Pharm-D programme) provided the course work is completed in one year or in first two semesters.

The Curriculum for Pharm-D and M.Phil as prepared by the National Curriculum Revision Committee are at Annex-A & B, respectively.
PHARM-D FIVE-YEAR COURSE
SCHEME OF STUDIES FOR ANNUAL SYSTEM

First Professional

(Theory)
Paper 1  Pharmaceutical Chemistry-I (Organic)  100
Paper 2  Pharmaceutical Biochemistry  100
Paper 3  Pharmaceutics-I (Physical Pharmacy)  100
Paper 4  Physiology & Histology  100
Paper 5  Anatomy  50
Paper 6  Pharmaceutical Mathematics & Biostatistics  100

(Practicals)
Paper 7  Pharmaceutical Chemistry-I (organic)  100
Paper 8  Pharmaceutical Biochemistry  100
Paper 9  Pharmaceutics-I (Physical Pharmacy)  100
Paper 10  Physiology & Histology  100

Total Marks: 950

Second Professional

(Theory)
Paper 1  Pharmaceutics-II (Pharmaceutical Preparations)  100
Paper 2  Pharmacology and Therapeutics-I  100
Paper 3  Pharmacognosy-I  100
Paper 4  Pharmaceutical Microbiology  100
Paper 5  Pakistan Studies and Islamiyat (Comp.)  100

(Practicals)
Paper 6  Pharmaceutics-II (Pharmaceutical Preparations)  100
Paper 7  Pharmacology & Therapeutics-I  100
Paper 8  Pharmacognosy-I  100
Paper 9  Pharmaceutical Microbiology  100

Total Marks: 900
### Third Professional

#### (Theory)

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<td>2</td>
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<td>3</td>
<td>Pharmacognosy-II</td>
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<td>4</td>
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#### (Practicals)

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<td>Pharmacognosy-II</td>
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**Total Marks: 900**

### Fourth Professional

#### (Theory)

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<td>Pharmaceutics-V (Clinical Pharmacy-I)</td>
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<td>Pharmaceutics-VI (Industrial Pharmacy)</td>
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<td>4</td>
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**Total Marks: 900**
## Final Professional

### (Theory)

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<td>Paper 2</td>
<td>Pharmaceutics-IX (Clinical Pharmacy-II)</td>
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<td>Paper 3</td>
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<td>Paper 4</td>
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<td>Paper 5</td>
<td>Pharmaceutical Management &amp; Marketing</td>
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<td>Paper 6</td>
<td>Computer and its Applications in Pharmacy</td>
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Total Marks: **900**
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. ORGANIC REACTIONS: Baeyer-Villiger oxidation; Diels Alder reaction; Grignard's reaction, Metal hydride reduction and Wolf Krishner reduction, Friedel Craft’s reaction, Perkin reaction, Cannizzaro reaction.


6. CARBANIONS: Condensation reaction (Aldol condensation; Favorskii rearrangement; Witting reaction).

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


9. 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 and Aniline.

10. PREPARATION AND PROPERTIES OF MEDICINALLY IMPORTANT HETEROCYCLIC COMPOUNDS such as: Pyrrol, Furan, Thiophene, Pyridine, Pyrimidine and Pyrazine.

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

PHARMACEUTICAL CHEMISTRY-I (ORGANIC) PRACTICAL

Paper 7 100 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.


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

Recommended Books
PHARMACEUTICAL 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, Nucleosides, Nucleotides, Structures of nucleic acids, Biological and pharmaceutical importance of nucleic acids.

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

   (f) Hormones: Chemistry, Classification (Proteinous and non-proteinous 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.

**PHARMACEUTICAL BIOCHEMISTRY (PRACTICAL)**

Paper 8  
100 Marks

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

(a) Definition and Fundamental concept.

(b) Properties contributing to Rheological behaviour.

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

1. 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. Preparation of Buffer solutions and isotonic solution.

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

6. Partition-coefficient, surface tension, viscosity.

Recommended Books
3. Bentley’s Pharmaceutics, All India Traveler Book Seller, New Delhi, 1996.
PHYSIOLOGY & HISTOLOGY (WRITTEN)

Paper 4  

PHYSIOLOGY


4. **SKIN**: Structure, Functions of skin, Temperature regulation by Skin.

5. **DIGESTIVE SYSTEM**: Mastication, Deglutation, Digestive juices-saliva, Gastric juice, pancreatic juice. Bile and intestinal juices; their composition, Functions and mechanism of secretion, Movements of the stomach and intestines. Functions of large intestine. Defecation. Functions of liver and gall bladder.


Descending tracts of spinal cord. Basal ganglia, Cerebellum. Autonomic Nervous system. Thalamus. CSF.

9. **SPECIAL SENSE:** Elementary knowledge of structure and function of the special senses.

10. **ENDOCRINOLOGY:** Definition of Hormone, Nature of different types of hormones and Mechanism of action of hormones.

   (a) **Pituitary Hormones:** Growth Hormone, Prolactin, ACTH, TSH, ADH, Oxytocin. Acromegaly, Gigantism, Panhypopituitarism.

   (b) **Thyroid Gland:** Thyroxin, Tri-iodothyronin, Format and functions of thyroid hormones. Hyperthyroidism, Myxodene.

   (c) **Parathyroid Hormone**

   (d) **Pancreatic Hormone:** Insulin, Glucagon, Diabetes mellitus.

   (e) **Adrenal Glands:** Mineralocorticoids, Glucocorticoids, Anabolic Steroids, Adrenalin, Nor-adrenalin, Cushing syndrome, Addison disease.

   (f) **Sex Hormones:** Male Sex Hormone, structure and function.
      Female Sex Hormone: Structure and function.

**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.

**PHYSIOLOGY& HISTOLOGY (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. 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.


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.

**Histology includes:**
1. Demonstration of the Preparation and staining of slides.
3. Organ system — Lung, Kidney, Appendix, Skin, Gall bladder, Stomach, Intestine.

**Recommended Books**

**Physiology**

**Histology**

**ANATOMY (WRITTEN)**

Paper 5

50 Marks

1. **INTRODUCTION: ANATOMICAL TERMINOLOGY.** Definition. Cell, tissue, organ system.


3. **TISSUE OF BODY:** Types of tissues with examples
   (a) Epithelial Tissue: General characters, classification.
   (b) Connective Tissue: Structure, types (Connective tissue proper, Cartilage. Bones structure and types of bones and joints).
   (c) Muscle: Structure of — Skeletal muscle, Smooth muscle, Cardiac muscle.

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

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 Organisation of N.S.

**Recommended Books**

**PHARMACEUTICAL MATHEMATICS AND BIOSTATISTICS (WRITTEN)**

<table>
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<tr>
<th>Paper 6</th>
<th>100 Marks</th>
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<tr>
<td><strong>Part A</strong></td>
<td>Pharmaceutical Mathematics</td>
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</table>
1. ALGEBRA:
   (b) Solution of Linear and Quadratic Equations, Equations reducible to Quadratic Form. Solution of simultaneous Equations.
   (c) Arithmetic, Geometric and Harmonic Progressions, Arithmetic, Geometric and Harmonic Means.
   (d) Permutations and Combinations
   (e) Binomial Theorem: Simple application.


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.


5. INTEGRAL CALCULUS: Concept of Integration. Rules of Integrations. Integrations of Algebric and Trignomtric functions by using different techniques.

Part B BIOSTATISTICS (60 MARKS)

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.

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


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.

**Recommended Books**

**Pharmaceutical Mathematics & Biostatistics**


SECOND PROFESSIONAL

PHARMACEUTICS-II (PHARMACEUTICAL PREPARATIONS)  WRITTEN

Paper 1         100 Marks

1. **Introduction:** Dosage form. Ingredients.


5. **Solvents used in Pharmaceutical Preparations.**


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.


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


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


**PHARMACEUTICS-II (PREPARATIONS) PRACTICALS**

Paper 6 100 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. Preparation of simple syrup, Orange syrup, Ferrous sulphate syrup, Cod Liver oil Emulsion, Liquid paraffin Emulsion, Throat paint (Mandle’s paint), Boroglycerine glycerite, Tannic acid glycerin, Spirit ammonia aromatic, Spirit of Ethyl Nitrite. Preparation of Methyl salicylate ointment, Sulphur ointment, Calamine lotion, Iodine tincture, Preparations of oral hygiene products, Poultice of Kaolin, Effervescent granules, Distilled Water for injections. (A minimum of twenty practical will be conducted)

**Recommended Books**

5. Sprowl’s (Dittert LW; Edt), American Pharmacy, 7th Ed, J B Lippincott Co, 1990.

**PHARMACOLOGY AND THERAPEUTICS-I (WRITTEN)**

**Paper 2**

100 Marks

1. GENERAL PHARMACOLOGY

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

(b) **Routes of drugs administration:** Advantages and disadvantages of Enteral Routes, Advantages and disadvantages of Parenteral Routes and Advantages and disadvantages of Topical Routes.

(c) **Pharmacokinetics:** Drug solubility and passage of drugs across the body membranes, Plasma concentration of drugs and various factors affecting it (Absorption and factors influencing the rate of absorption (GIT and other routes) of drugs, Distribution and factors influencing the rate of distribution of drugs, Biotransformation and factors influencing the rate of biotransformation of drugs, Excretion, channels of excretion and factors influencing the rate of excretion of drugs), Definition of (Bioavailability & Bioequivalence, Therapeutic Index, Plasma Half Life \(t_{1/2}\)), Dose-Response Curve, Area Under Curve, Volume of Distribution

(d) **Pharmacodynamics:** Drug receptors and theories, Mechanisms of drug action, Specificity of drug action and Factors modifying the action & dosage of drugs.

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 Non-catecholamines.

(d) Sympathetic antagonist drugs: Adrenergics Nerve Blockers, Adrenoceptor antagonists (Alpha-adrenergic blockers and Beta-adrenergic blockers).
(e) Parasympathetic (Cholinergic) agonists and Anticholinesterase inhibitors.
(f) Parasympathetic antagonists.
(g) Drugs acting on Ganglia (Ganglian stimulants and Ganglion blockers).
(h) Neuromuscular blocking drugs

3. DRUGS ACTING ON GASTROINTESTINAL TRACT:

(a) Emetic.
(b) Anti-emetics.
(c) Purgatives: Bulk forming purgatives, Lubricant purgatives, Irritant purgatives and Saline Purgatives.
(d) Anti-diarrheal Agents.
(e) Treatment of Peptic & Dudenal Ulcers: Antiacids, H2-Receptor Antagonists, Antimuscarinic Agents, Proton Pump Inhibitors, Gastrin Receptor Antagonist and Cytoprotective agents.
(f) Drug treatment of chronic inflammatory diseases of bowel.
(g) 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) Drug treatment of Bronchial Asthma (Bronchodilators, Cromoglycate, Nedocromil, Corticosteroids & other Anti-inflammatory drugs and Muscarinic receptor antagonists)

6. DRUGS ACTING ON CARDIO-VESSCULAR SYSTEM:
(a) Angina pectorus and its drug treatment
(b) Congestive heart failure & its treatment
(c) Anti-arrhythmic drugs
(d) Agents used in Hyperlipidemia
(e) Coagulants and Anti-coagulants
(f) Anti-hypertensives
(g) Diuretics

7. DRUGS ACTING ON GENITOURINARY SYSTEM:
Oxytoxic drugs, Ergot alkaloids and uterine relaxants
8. **ANTI-ANAEMIC DRUGS:**

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

**PHARMACOLOGY & THERAPEUTICS-I (PRACTICALS)**

**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. 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 demonstrate 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 20 practicals will be conducted)
Recommended Books
10. Prof Dr A Qayum, *Fundamentals of Experimental Pharmacology*.

PHARMACOGNOSY-I (WRITTEN)

Paper 3 100 Marks


2. THE STUDY OF THE CRUDE DRUGS BELONGING TO VARIOUS FAMILIES OF MEDICINAL IMPORTANCE
   Families                    Crude Drugs
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. Solanaceae Belladonna, Hycscyamus, Stramonium Capsicum.
g. Scrophulariaceae Digitalis, Verbascum (Mullien).
h. Labiatae Peppermint, Thyme, Spearmint, Salvia, Ocimum.
i. Liliaceae Garlic, Colchicum, Aloe.
j. Zingiberaceae Ginger, Curcuma.

3. GROWTH REGULATORS: General account with special reference to Auxins, Gibberellins Abscisic acid, Cytokinins and Ethylene.


6. POISONOUS PLANTS: General introduction of poisonous plants with special reference to Pakistan.


**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. (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 Northern Areas of the country.

**Recommended Books**

**PHARMACEUTICAL MICROBIOLOGY (WRITTEN)**

**Paper 4**

**100 Marks**

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


2. **ORGANISMS:**
   - 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 inhabitants 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).


8. FACTORY AND HOSPITAL HYGIENE AND GOOD MANUFACTURING PRACTICE:

PHARMACEUTICAL MICROBIOLOGY (PRACTICALS)

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. 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
3. Lippincot, Microbiology by lipponcott, William & Willkin, USA, 2001

**PAKISTAN STUDIES AND ISLAMIYAT (Comp.) WRITTEN**

**Paper 5**

100 Marks

As per syllabi of B.A/B.Sc. Classes, approved by the respective University.
THIRD PROFESSIONAL

PATHOLOGY (WRITTEN)

Paper 1 50 Marks

1. SCOPE OF PATHOLOGY & CONCEPT OF DISEASES.


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

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

PATHOLOGY (Laboratory)

Paper 6 50 Marks

Study of Pathological Slides of various Pathological Conditions

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 diseases, Gastric Analysis, Tests for liver function, Renal function test, Tests for endocrine abnormalities, Biopsies and cytologic techniques.

**Recommended Books**

**PHARMACOLOGY AND THERAPEUTICS-II (WRITTEN)**

**Paper 2**

1. **DRUGS ACTING ON CENTRAL NERVOUS SYSTEM**
   (b) CNS – Stimulants: Cerebral Stimulants, Medullary stimulants, Spinal Cord Stimulants, Anti-depressants, Psychotomimetic or Hallucinogens, Psychotherapeutic Agents (Anxiolytics and Anti-psychotics), Drug treatment of Epilepsy and Drug treatment of Parkinsonism and other movement disorders.

2. **ANAESTHETICS**
   (a) Anesthesia and its clinical importance.
   (b) General Anaesthesia, Mechanism of action and its application.
   (c) General Anaesthetics
   (d) Local Anaesthetics
   (e) Spinal Anaesthesia and drug used
   (f) Techniques of Local Anaesthesia

3. **CHEMOTHERAPY**
   (a) Classification of drugs.
   (b) Anti-microbials: Sulphonamides, Anti-virals, Antiprotozoals (Treatment of Malaria and Treatment of Amebiasis), Anti-fungals,
Anthelmintics, Anti-neoplastic and Immunosuppressive drugs,
Drug treatment of Leprosy and Anti-biotics (Penicillins, Cephalo-
sporins, Aminoglycosides, Tetracyclines, Chloramphenicol,
Macrolides, Quinolones and Miscellaneous Anti-biotics).
(c) Anti-hypertensive Drugs.
(d) Steroids and Anti-steroid drugs.

4. **HORMONES, ANTAGONISTS AND OTHER AGENTS AFFECTING
   ENDOCRINE FUNCTION**

(a) Endocrine function and dysfunctions.
(b) Drug used for therapy of Diabetes Mellitus: Insulin and Oral
   Hypoglycemic agents.
(c) Corticosteroids
(d) Thyroid hormone and anti-thyroid drugs

5. **TOXICOLOGY**

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

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

Recommended Books
10. Prof Dr A Qayum, *Fundamentals of Experimental Pharmacology*.  


**PHARMACOGNOSY-II (WRITTEN)**

**Paper 3**  
**100 Marks**

1. **SEPARATION AND ISOLATION OF PLANT CONSTITUTIONS:**  
   An introduction to chromatography and chromatographic techniques e.g. Adsorption Chromatography and Partition Chromatography.

2. **CARBOHYDRATES:** Introduction of carbohydrate.  
   (a) **Sucrose and Sucrose containing drugs:** Sucrose, Dextrose, Liquid glucose, Fructose, Lactose, Xylose, Caramel, Honey, Starch, Inulin, Dextrine etc.  
   (b) **Cellulose and Cellulose Derivatives:** Purified cotton, Powdered cellulose, Microcrystalline cellulose, Methyl cellulose, Sodium Carboxy-methyl cellulose.  
   (c) **Gums and Mucilages:** Tragacenth, Acacia, Sodium Alginate, Agar, Pectin.

3. **GLYCOSIDES:** Introduction, classification, chemistry and medicinal uses of:  
   (a) **Cardioactive glycosides:** Digitalis, Strophanthus and white squill.  
   (b) **Anthroquinone glycosides:** Cascara, Aloe, Rhubarb, Cochineal and Senna.  
   (c) **Saponin glycosides:** Glycyrhiza, Sarsaparilla.  
   (d) **Cyanophore glycosides:** Wild cherry.  
   (e) **Isothiocyanate glycosides:** Black Mustard.  
   (f) **Lactone glycosides:** Cantharide.  
   (g) **Aldehyde glycosides:** Vanilla.  
   (h) **Miscellaneous glycosides:** Gentian, Quassia, Dioscorea.

4. **TANNINS:** Introduction, classification, properties and chemical identity tests of Tannins and Tannin containing compounds. Detailed study of Hammamelis, Catechu and Nut Galls.
5. **VOLATILE OILS (ESSENTIAL OILS):** Introduction, significance, methods of obtaining volatile oils, chemistry and classification of:
   (a) Hydrocarbon volatile oils: Cubeb and Terpentine 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.

6. **RESINS AND RESIN COMBINATION:** Introduction, properties and difference between glycoresins, oleoresins, oleo-gum resins and balsams.
   (a) Resins: Rosin, Cannabis.
   (b) Glycoresins: Podophyllum, Jalap, Ipomoea, Colocynth.
   (c) Oleoresins: Terpentine, Capsicum, Ginger.
   (d) Oleo-gum resins: Asafoetida, Myrrh.
   (e) Balsams: Storax, Peruvian balsam, Tolu balsam, Benzoin.

7. **ALKALOIDS:** Introduction, Properties, Classification, Function of alkaloids in plants, Methods of extraction and identification tests.
   (a) Pyridine — Piperidine Alkaloids: Areca nut, Lobelia, Tobacco.
   (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.

8. **LIPIDS:** Introduction. Detailed study of:
   (a) Fixed Oils: Castor oil, cotton seed oil, olive oil, peanut oil, sunflower 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.

9. **TUMOUR INHIBITORS FROM PLANT:** Detailed study of various anti-tumour agents isolated from plants.
PHARMACOGNOSY-II (PRACTICALS)

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

Recommended Books

PHARMACEUTICS-III (DISPENSING AND COMMUNITY PHARMACY) WRITTEN

Paper 4  100 Marks (40+60)

PART ‘A’  DISPENSING (40 Marks)

1. Basic Principles of Compounding and Dispensing Including: Weights and Measures, Calculations for compounding and Dispensing, 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.

4. **Classical dosage Forms.**

5. **I.V. Admixtures.**

6. **Radio-Pharmacy — Techniques and Applications.**

**PART ‘B’ COMMUNITY PHARMACY (60 Marks)**

1. **DEFINITIONS AND BACKGROUND**

2. **PUBLIC HEALTH AND COMMUNITY PHARMACY:** Epidemology & its Control, Preventive Health (EPI & CDC), Family Planning and Health Policy & National Drug Policy.

3. **PATIENT ASSESSMENT**

4. **MEDICAL COMPLICATION OF DRUG TAKING:** General and Socio-economic Aspects.

5. **PATIENT PHARMACIST COMMUNICATION.**

6. **PATIENT EDUCATION AND COUNSELLING.**

7. **CONTROL OF DRUG ABUSE AND MISUSE.**

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

**PHARMACEUTICS-III (DISPENSING AND COMMUNITY PHARMACY) PRACTICALS**

**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, indiffusible 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)

**Recommended Books**

2. Hussa’s Dispensing.
3. Roy Robertson, **Management of Drug Users in the Community**: A practical Handbook.
5. Martindale's **Extra Pharmacopia**.

**PHARMACEUTICAL CHEMISTRY-II (INSTRUMENTATION) (WRITTEN)**

Paper 5 100 Marks

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

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

1. **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.

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

4. **DIFFERENTIAL SCANNING CALORIMETRY**

**PHARMACEUTICAL CHEMISTRY-II (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. **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 & Role of Pharmacist
   (d) Benefits and problems
   (e) Keeping up to date Formulary
   (f) Contraceptives

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:
   (a) Medication error
   (b) Evaluation & Precautions of Medication Error
   (c) 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 Hyperalimentation.

14. ROLE OF PHARMACISTS 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).
23. COMMON KNOWLEDGE OF ABOUT 100 DRUGS REGISTERED BY MINISTRY OF HEALTH, GOVERNMENT OF PAKISTAN

**Recommended Books**


**PHARMACEUTICS-V CLINICAL PHARMACY-I (WRITTEN)**

*Paper 2*  
100 Marks

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

2. **PATIENT PROFILE:**
   (a) Patient disease profile
   (b) Taking case History
   (c) Drug Profile of 25 Drugs (Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cephalosporins, Chlorpheniramine, Cimetidine, Digoxin, Dobutamine, Dopamine, Fluroquinolone, Frusemide, Lactulose, Macrolides, Metoclopramide, Morphine/Pethedine, Nifedipine, NSAIDS, ORS, Penicillins, Prednisolone, Salbutamol, Vancomycin)

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. **ADVERSE DRUG REACTIONS:**
   Adverse Drug Reactions and Side Effects: Classification, Excessive pharmacological response, Idiosyncrasy, Secondary pharmacological effects, Allergic drug reactions, General toxicity, Toxicity following drug withdrawal, Detection, reporting & Management of ADR.
7. **DRUG INDUCED DISEASES.**

8. **COMPUTERS IN CLINICAL PHARMACY.**

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

**PHARMACEUTICS-V CLINICAL PHARMACY-I (PRACTICAL)**

**Paper 6**  
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.

**Recommended Books**


1. **MASS TRANSFER.**

2. **HEAT TRANSFER.**

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


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

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

7. **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).

8. **SAFETY METHODS IN PHARMACEUTICAL INDUSTRY:**
   (a) Mechanical, chemical and fire hazards problems.
   (b) Inflammable gases and dusts.

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

10. **SUSPENSIONS:**
    Formulation of suspensions, Equipment used in preparation and test methods for pharmaceutical suspensions.
11. SEMISOLIDS:
Equipment used for Ointments, Pastes, Gels and Jellies. Packaging of ointments.

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

13. STANDARDIZATION OF PHARMACEUTICALS:

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.

16. STUDY TOUR:
A visit to the pharmaceutical industries will be an integral part of the syllabi.

PHARMACEUTICS-VI (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 coating and Enteric Coating). Clarification of liquids by various processes. Size Reduction. Homogenization. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables. Capsule filling by semi automatic machines. Manufacture of sustained action drugs. Tablets Tests like Disintegration. Dissolution. Friability. Hardness and thickness tests. Determination of weight variation in tablets. Density of powder. Particle size analysis. (Note: A minimum of 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 Northern Areas of the country.

**Recommended Books**

**PHARMACEUTICS –VII (BIOPHARMACEUTICS) (WRITTEN)**

**Paper 4**  
100 Marks

1. **DEFINITIONS AND TERMINOLOGY:**  
   Biopharmaceutics, Generic Equivalence, Bioavailability, Bioequivalence, Drug Disposition, Therapeutics, Pharmacokinetics, Biotransformation and Therapeutic Equivalents.

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

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

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

5. **MULTIPLE DOSAGE REGEMIN.**

6. **INTRA VENOUS INFUSIONS.**
7. BIOPHARMACEUTICAL AND PHARMACOKINETIC ASPECTS IN DEVELOPING A DOSAGE FORM.

8. INTRODUCTION TO PHARMACOKINETICS:
   Determination through plasma drug level studies. Application of pharmacokinetics in clinical situations.

9. CONCEPT OF COMPARTMENT(S) MODELS:
   One compartment open model. Two compartment open model. Three compartment open model and Non-compartmental method of analysis.

10. BIOLOGICAL HALF-LIFE AND VOLUME OF DISTRIBUTION:
    Concept and Methods of Determination.

11. DRUG CLEARANCE:
    Mechanism, determination and relationship of clearance with half-life.

12. ELIMINATION 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, Mammary excretion, Skin excretion and Genital excretion.

13. PROTEIN BINDING:
    Determination of plasma protein binding and Clinical significance of drug-protein binding.

14. APPLICATIONS OF PHARMACOKINETICS AND BIOAVAILABILITY IN CLINICAL SITUATIONS.

15. APPLICATIONS OF PHARMACOKINETICS IN DISEASE STATES.
PHARMACEUTICS –VII (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. **SCOPE:**
   (a) An understanding of the testing, quality control program and methods adopted in a pharmaceutical industry, dosage form control, process control, testing programme and methods, physical, chemical and biological tests and specifications, statistical quality control.

   (b) General understanding of Total Quality Assurance and measures to adopt Quality Assurance.

2. **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. **EVALUATION OF SUSTAINED ACTION PRODUCTS (TABLETS & CAPSULES):**
   Stability of viability rate during storage and In-vitro & In-vivo evaluation of sustaining action.

5. **QUALITY CONTROL OF SUPPOSITORIES:**
   Disintegration test, Uniformity of weight, Assay of active ingredients, Liquefaction time test and Breaking test.

6. **QUALITY CONTROL OF STERILE PRODUCTS (PARENTERALS):**
   Leaker’s test, Clarity test, Pyrogen test for Parenteral and other sterile preparations and Assay for active ingredients.

7. **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.
8. **ALCOHOL DETERMIANTION**: Alcoholometric methods, Problem during distillation of alcohol, Method for liquids containing less than 30% or more than 30% alcohol and special treatment before distillation.

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


11. **GENERAL KNOWLEDGE OF APPENDICES ATTACHED TO B.P., BPC, AND USP.**

12. **STATISTICAL INTERPRETATION OF QUALITY CONTROL CHARTS DURING MANUFACTURING PROCESSES.**

**PHARMACEUTICS-VIII (PHARMACEUTICAL QUALITY CONTROL) (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. INTRODUCTION TO MEDICINAL CHEMISTRY:
   Chemical constitution and biological activity: (Receptor, Theory, Structure Activity Relationships (SAR) and Drug Metabolism).

2. CLASSIFICATION OF SYNTHETIC DRUGS:
   Drug Design and recent approaches to the synthesis of drugs (a brief concept of methods and reactions of synthesis of various drugs).

3. GENERAL PROPERTIES, CHEMISTRY BIOLOGICAL ACTION, STRUCTURE ACTIVITY RELATIONSHIP AND THERAPEUTIC APPLICATIONS OF THE FOLLOWING:
   (a) Alicyclic Compounds: Cyclopropane, Terpenes, Citral, Pinene, Camphor, Menthol, Carotenes.
   (b) Alkaloids: Atropine, Morphine and related compounds (Codeine, Thebaine), Ergotamine, Reserpine, Ephedrine.
   (c) Vitamins: Water Soluble Vitamins (B₁, B₂, B₆, B₁₂, Folic acid, Nicotinic acid, Biotin, Pantothenic acid and Ascorbic acid) Fat Soluble Vitamins (A, D, E, and K).
   (d) Hormones: Steroidal Hormones (Testosterone, Progesterone, Estrogen, Aldosterone and Cortisol), Proteinous Hormones (Insulin, Glucagon, Oxytocin and Vassopressin).
   (e) Anti-neoplastic Agents: Tamoxifen, Fluorouracil, Mercapturine, Methotrexate and Vincreistine.
   (f) Sedatives and Hypnotics: Benzodiazepines, Barbiturates, Paraldehyde, Glutethimide, Chloral hydrate, and alcohols.
   (g) 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).
   (h) Analgesics and Antipyretics: Paracetamol, Salicylic acid analogues, Quinolines derivatives, Pyrazolone and Pyrazolodiones, N-arylanthranilic acids, Aryl and heteroaryl acetic acid derivatives.
(i) Antiseptics: Phenols and related compounds, Halogens and Halogen compounds, Aromatic acid and esters, Dyes, Nitrofuran derivatives, Formaldehyde and its derivatives, Mercurochrome and Thiomersal.

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

(k) Antimalarials: 4-Aminoquinolines, 8-Aminoquinolines, 9-Amino acridines, Biguanides, Pyrimidine analogues, Mefloquine and Cinchophen alkaloids.

(l) Anthelmintics: Phenols and related compounds, Piperazine derivatives, Thiabendazole, Mebendazole and Pyrantal.

(m) Diuretics: Mercaptopurine, Meralluride, Thiazides, Spironolactone, Theophylline, Furosemide, Acetazolamide, Ethacrynic acid and Triameterene.

(n) Antitubercular Drugs: Ethambutol, Isonicotinic acid, Hydrazid, Rifampicin, Thioguanine, Pyrazinamide, Cycloserine, Ethunamide, Cytosine Arabinoside, 5-Flourouracil and Dacarbazine.

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

(p) Immunosuppressant Agents: Azathioprine and Cyclosporin.

4. ANTIBIOTICS:
Penicillins, Cephalosporins, Streptomycin, Chloramphenicol, Tetracyclines, Kanamycin and Erythromycin.

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.

PHARMACEUTICAL CHEMISTRY-III (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-benzoazol-2-one, Aspirin, P-nitrosophenol, 3-nitrophthalic acid, o-
(Note: A minimum of 20 practicals will be conducted)

**Recommended Books**


**PHARMACEUTICS-IX (CLINICAL PHARMACY-II) (WRITTEN)**

**Paper 2**

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

4. **DRUG ABUSE & MISUSE.**

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

6. **PHARMACOECONOMIC STUDIES.**

7. **PHARMACEUTICAL CARE, ITS SCOPE, MANAGEMENT AND APPLICATION OF CARE PLAN:**
8. ROLE OF CLINICAL PHARMACIST IN COMMUNITY PHARMACY

9. CLINICAL THERAPEUTICS:
   (b) Basic introduction of some clinical situations, their clinical features, etiology, pathophysiology and treatment of causes: Common Cold, Pharyngitis and Tonsillitis, Pneumonia, Tuberculosis, Diarrhea, Malaria, Meningitis, Tetanus, Typhoid Fever, Measles, Rabies, AIDS, Congestive cardiac failure, Conjunctivitis, Anemia, Gout, Asthma, Ulcer, Diabetes mellitus, Hypertension, Hepatitis, Dermatology (Scabies, Fungal diseases).

10. 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.

11. SAVE INTRAVENOUS THERAPY & HAZARDS OF INTRAVENOUS THERAPY.

12. 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.

**PHARMACETICS-IX 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.

**Recommended Books**


**PHARMACEUTICAL TECHNOLOGY (WRITTEN)**

**Paper 3**

**100 Marks**

1. **PRINCIPLES OF PHARMACEUTICAL FORMULATION AND DOSAGE FORM DESIGN:** Product Formulation, Need for Dosage Form and Preformulation Studies.

2. **FORMULATION DEVELOPMENT:** Pharmaceutical Aerosols, Ophthalmic Preparations, and Parenteral Preparations.

3. **ADVANCED FORMULATION TECHNIQUES:** Development of a formulation methodology and flow plan for the new product. New technologies in drug delivery system.

4. **NOVEL DRUG DELIVERY SYSTEMS:**
   a) Introduction to the Drug Carrier: Liposome, Noisome and Biodegradable polymers.
   b) Active & Passive Drug Delivery System.
   c) Other Novel GIT Systems.

5. **MODIFIED DRUG RELEASE DOSAGE FORM:**
   The concept of sustained release, First order release approximation, Multiple dosing, Implementation of designing, Approaches based upon dosage form modification, Product evaluation and testing, Matrices tablets, Control release technology, Micro encapsulation, Method of particle coating and Instrumentation in granule manufacturing.
6. **PHARMACEUTICAL BIOTECHNOLOGY:**
   Biotechnological aspects in the product development, Fundamentals of Genetic Engineering and its Application in Medicine, Principle, Synthesis and Application of Monoclonal Antibodies, Introduction to Gene therapy, Immobilized Enzymes and their application in Medicine, General Principle and Methods of Microbial Assay.

**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**


**FORENSIC PHARMACY (WRITTEN)**

**Paper 4**  
100 Marks

1. **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.

2. **THE PHARMACY ACT, 1967.**

3. **THE DANGEROUS DRUGS ACT, 1930.**

4. **THE FACTORY LAW 1934.**

5. **SHOPS AND ESTABLISHMENT ORDINANCE, 1969 WITH RULES.**

6. **THE POISONS ACT, 1919.**

7. **CONTROL OF NARCOTICS SUBSTANCES ACT 1997.**

**Recommended Books**

3. The Poisons Act 1919.
4. The Dangerous Drugs Act 1930.
5. The Factory Law 1934.

**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
   f) Motivation
   g) Innovation and creativity
   h) Communication

2. PRODUCTION MANAGEMENT:
   (a) Material Management.

3. MARKETING MANAGEMENT:
   Marketing channels, Promotion and Advertising and Salesmanship.

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

5. PHARMACY LAYOUT DESIGN:

**Recommended Books**

**COMPUTER AND ITS APPLICATION IN PHARMACY (WRITTEN)**

Paper 6 50 marks


4. **Data Communication**: Applications of Data Communication, Components of a data communication system, Rate of data Transmission, Computer Networks, Network Topology, Gateway, E-mail/Internet concepts.

**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.


3. **Complete Statistical Package like SPSS**.

4. **Languages**: At least two prevailing languages will be taught.

**Recommended Books**


**NOTE:** The candidates are required to work for a minimum of 300 hours in Pharmaceutical Manufacturing unit, Retail/Community Pharmacy/Hospital setting after the final year examination. They must maintain a diary of work signed daily by the Manager.
# Scheme of Courses for Pharm-D
## For Semester System
### 1st Professional Pharm-D

<table>
<thead>
<tr>
<th>1st Semester</th>
<th>2nd Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course No.</strong></td>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td>301</td>
<td>Pharmaceutical Chemistry-I (Organic-I) [Th.]</td>
</tr>
<tr>
<td>303</td>
<td>Pharmaceutical Chemistry-I (Organic-I) [Lab.]</td>
</tr>
<tr>
<td>305</td>
<td>Pharmaceutical Biochemistry-I [Th.]</td>
</tr>
<tr>
<td>307</td>
<td>Pharmaceutical Biochemistry-I [Lab.]</td>
</tr>
<tr>
<td>309</td>
<td>Pharmaceutics-I (Physical Pharmacy-1) [Th.]</td>
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<tr>
<td>311</td>
<td>Pharmaceutics-I (Physical Pharmacy-1) [Lab.]</td>
</tr>
<tr>
<td>313</td>
<td>Physiology &amp; Histology-I [Th.]</td>
</tr>
<tr>
<td>315</td>
<td>Physiology &amp; Histology-I [Lab.]</td>
</tr>
<tr>
<td>317</td>
<td>Anatomy</td>
</tr>
<tr>
<td>319</td>
<td>Pharmaceutical Mathematics</td>
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<td><strong>Total Cr. Hr.</strong></td>
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### 2nd Professional Pharm-D

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Course No.</strong></td>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td>401</td>
<td>Pharmaceutics-III (Pharmaceutical Preparations-I) [Th.]</td>
</tr>
<tr>
<td>403</td>
<td>Pharmaceutics-III (Pharmaceutical Preparations-I) [Lab.]</td>
</tr>
<tr>
<td>405</td>
<td>Pharmacology &amp; Therapeutics-I (General-I) [Th.]</td>
</tr>
<tr>
<td>407</td>
<td>Pharmacology &amp; Therapeutics-I (General-I) [Lab.]</td>
</tr>
<tr>
<td>409</td>
<td>Pharmacognosy-I [Th.]</td>
</tr>
<tr>
<td>411</td>
<td>Pharmacognosy-I [Lab.]</td>
</tr>
<tr>
<td>413</td>
<td>Pharmaceutical Microbiology-I [Th.]</td>
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<tr>
<td>415</td>
<td>Pharmaceutical Microbiology-I [Lab.]</td>
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<td>417</td>
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### 3rd Professional Pharm-D

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<tr>
<td><strong>Course No.</strong></td>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td>501</td>
<td>Pathology [Th.]</td>
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<tr>
<td>503</td>
<td>Pathology [Lab.]</td>
</tr>
<tr>
<td>505</td>
<td>Pharmacology &amp; Therapeutics-III (Systemic Pharmacology-I) [Th.]</td>
</tr>
<tr>
<td>507</td>
<td>Pharmacology &amp; Therapeutics-III (Systemic Pharmacology-I) [Lab.]</td>
</tr>
<tr>
<td>509</td>
<td>Pharmacognosy-III [Th.]</td>
</tr>
<tr>
<td>511</td>
<td>Pharmacognosy-III [Lab.]</td>
</tr>
<tr>
<td>513</td>
<td>Pharmaceutical Chemistry-III (Instrumentation-I) [Th.]</td>
</tr>
<tr>
<td>515</td>
<td>Pharmaceutical Chemistry-III (Instrumentation-I) [Lab.]</td>
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<tr>
<td>517</td>
<td>Pharmaceutics-V (Dispensing Pharmacy) [Th.]</td>
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<tr>
<td>519</td>
<td>Pharmaceutics-V (Dispensing Pharmacy) [Lab.]</td>
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### Fourth Professional Pharm-D

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<tbody>
<tr>
<td><strong>Course No.</strong></td>
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<tr>
<td>601</td>
<td>Pharmaceutics-VII (Hospital Pharmacy-I) [Th.]</td>
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<tr>
<td>603</td>
<td>Pharmaceutics-VIII (Clinical Pharmacy-I) [Th.]</td>
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<tr>
<td>605</td>
<td>Pharmaceutics-VIII (Clinical Pharmacy-I) [Lab.]</td>
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<tr>
<td>607</td>
<td>Pharmaceutics-IX (Industrial Pharmacy-I) [Th.]</td>
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<tr>
<td>609</td>
<td>Pharmaceutics-IX (Industrial Pharmacy-I) [Lab.]</td>
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<tr>
<td>611</td>
<td>Pharmaceutics-X (Biosciences I) [Th.]</td>
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<tr>
<td>613</td>
<td>Pharmaceutics-X (Biosciences I) [Lab.]</td>
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<tr>
<td>615</td>
<td>Pharmaceutics-XI (Pharmaceutical Quality Management-I) [Th.]</td>
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<tr>
<td>617</td>
<td>Pharmaceutics-XI (Pharmaceutical Quality Management-I) [Lab.]</td>
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**Final (Fifth) Professional Pharm-D**
### 1st Semester

<table>
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<tbody>
<tr>
<td>701</td>
<td>Pharmaceutical Chemistry-V (Medicinal-I) [Th.]</td>
<td>3</td>
<td>702</td>
<td>Pharmaceutical Chemistry-V (Medicinal-II) [Th.]</td>
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<td>Pharmaceutical Chemistry-V (Medicinal-I) [Lab.]</td>
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<td>705</td>
<td>Pharmaceutics-XVII (Clinical Pharmacy-III) [Th.]</td>
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<td>Pharmaceutics-XVII (Clinical Pharmacy-IV) [Th.]</td>
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<td>Pharmaceutics-XVII (Clinical Pharmacy-IV) [Lab.]</td>
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<td>709</td>
<td>Pharmaceutics-XVIII (Pharmaceutical Technology-I) [Th.]</td>
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<td>713</td>
<td>Pharmaceutics-XIX (Forensic Pharmacy-I) [Th.]</td>
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<td>Pharmaceutics-XIX (Forensic Pharmacy-II) [Th.]</td>
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<td>715</td>
<td>Pharmaceutics-XX (Pharmaceutical Management &amp; Marketing-I) [Th]</td>
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<td>Pharmaceutics-XX (Pharmaceutical Management &amp; Marketing-II) [Th]</td>
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**Total Cr. Hr.** 18

### 2nd Semester

<table>
<thead>
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<th>Cr. Hr.</th>
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<tbody>
<tr>
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<td>702</td>
<td>Pharmaceutical Chemistry-V (Medicinal-II) [Th.]</td>
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<tr>
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<td>Pharmaceutical Chemistry-V (Medicinal-I) [Lab.]</td>
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<td>704</td>
<td>Pharmaceutical Chemistry-V (Medicinal-II) [Lab.]</td>
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<tr>
<td>705</td>
<td>Pharmaceutics-XVII (Clinical Pharmacy-III) [Th.]</td>
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<td>706</td>
<td>Pharmaceutics-XVII (Clinical Pharmacy-IV) [Th.]</td>
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<td>Pharmaceutics-XVII (Clinical Pharmacy-III) [Lab.]</td>
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<td>Pharmaceutics-XVII (Clinical Pharmacy-IV) [Lab.]</td>
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<td>Pharmaceutics-XVIII (Pharmaceutical Technology-I) [Th.]</td>
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<td>Pharmaceutics-XVIII (Pharmaceutical Technology-II) [Th.]</td>
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<td>3</td>
<td>716</td>
<td>Pharmaceutics-XX (Pharmaceutical Management &amp; Marketing-II) [Th]</td>
</tr>
</tbody>
</table>

**Total Cr. Hr.** 18

### NOTE:

1. Two credit hours of mathematics will be equal to 40 marks. Four credit hours of Biostatistics will be equal to 60 marks.
2. Two credit hours of dispensing will be equal to 40 marks while one credit hour of practical will be equal to 60 marks.
3. In general, three credit hours of theory will be equal to 50 marks. One credit hour of practical will also be equal to 50 marks. Moreover, four credit hours will be equal to 100 marks.
4. One credit hour of practical means that there will be one practical class in a week and one practical class will not be less than 3 hours.

### PHARM-D. 1st SEMESTER 2nd SEMESTER TOTAL CR. HRs.

| 1st Prof. | 21 | 20 | 41 |
| 2nd Prof. | 19 | 19 | 38 |
| 3rd Prof. | 19 | 20 | 39 |
| 4th Prof. | 19 | 19 | 38 |
| Final Prof. | 18 | 18 | 36 |
| Total: | 98 | 98 | 192 |
DETAILS OF COURSES FOR PHARM-D
(SEMESTER SYSTEM)

FIRST PROFESSIONAL

FIRST SEMESTER

301 PHARMACEUTICAL CHEMISTRY-I (ORGANIC-I)
[Theory] Cr. Hr. 03

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. Tautomerism of carbonyl compounds.

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

3. ORIENTATION IN ELECTROPHILIC SUBSTITUTION REACTIONS ON BENZENE RING.

4. ORGANIC REACTIONS: Baeyer-Villiger oxidation; Diels Alder reaction; Grignard’s reaction, Metal hydride reduction and Wolf Krishner reduction, Friedel Craft’s reaction, Perkin reaction, Cannizzaro reaction, Wolf Kishner reduction.


6. CARBANIONS & THEIR STABILITY: Condensation reaction (Aldol condensation; Favorskii rearrangement; Witting reaction).

303 PHARMACEUTICAL CHEMISTRY-I (ORGANIC-I)
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
derived lipids), Reactions of Fatty acids and other Lipids, Essential fatty acids, Biological and pharmaceutical importance of lipids.

(c) **Proteins and Amino acids:** Chemistry, Classification of proteins and amino acids, Reactions of proteins and amino acids, Organizational levels, Macromolecular nature of proteins, Biological and pharmaceutical importance of proteins and amino acids.

(d) **Nucleic acids:** Chemistry, Types (DNA, RNA, Mrna, Trna, Rrna), Purine and Pyrimidine bases, Nucleosides, Nucleotides, Structures of nucleic acids, Biological and pharmaceutical importance of nucleic acids.

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

(f) **Hormones:** Chemistry, Classification (Proteinous and non-proteinous 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, Allostere enzymes, Factors affecting the rate of an enzyme-catalyzed reaction, Biological and pharmaceutical importance, Mechanism of action of some important enzymes (Chymotrypsin, Ribonuclease).

307 **PHARMACEUTICAL BIOCHEMISTRY-I (Laboratory)** Cr. Hr. 01

**NOTE:**- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. **Qualitative analysis of:** Carbohydrates, Amino acids, Peptides and Proteins, Lipids and Sterols (Cholesterol) Bile salts and billirubin, Blood analysis – Sugar, Uric acid, Billirubin, Cholesterol and Creatinine.

**Recommended Books**


309 **PHARMACEUTICS-I (PHYSICAL PHARMACY-I)**
(Theory)                     Cr. Hr. 03

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. **PHYSIOCHEMICAL 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, lyophilization, elutrition, exiccation, ignition, sublimation, fusion, calcination, adsorption, decantation, evaporation, vaporization, centrifugation, dessication, levigation and trituration.

4. **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.

311 PHARMACEUTICS-I (PHYSICAL PHARMACY-I)

(Laboratory) Cr. Hr. 01

**NOTE**: Practical s 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. Experiments to demonstrate some of the physico-chemical processes like simple distillation, steam distillation, crystallization and dialysis. Determination of particle size. Preparation of buffer solutions and isotonic solutions.

**Recommended Books**

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

313 PHYSIOLOGY & Histology-I (Theory) Cr. Hr. 03

**Physiology**

1. **BLOOD**: Composition of blood (RBC, WBC and Platelets), Functions and Genesis of the formed elements, Fate of Red Blood cells, Jaundice, Reaction of Blood, Blood groups, Rh factors, ESR Blood volume,


3. **RESPIRATORY SYSTEM**: Mechanics of respiration. Intrathoracic, intrapulmonary pressure, pulmonary ventilation. Lungs volume and capacities. Composition of Inspired air, expired air and alveolar air, carriage of O2 and CO2 by the blood. Regulation of breathing (Nervous & Chemical control). Respiratory changes in exercise, pneumonia, emphysema and bronchial asthma.

4. **DIGESTIVE SYSTEM**: Mastication, Deglutation, Digestive juices—saliva, Gastric juice, Pancreatic juice. Bile and intestinal juices; their composition, Functions and mechanism of secreation, Movements of the stomach and intestines. Functions of large intestine. Defecation. Functions of liver and gall bladder.


**Histology**

1. **Introductin of cell**: General structure of tissues in different systems of Body.

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

3. **Gastrointestinal tract**: GIT including exocrine organs: Liver, pancreas and Gall Bladder.


315 **PHYSIOLOGY & HISTOLOGY-I (Laboratory) Cr. Hr. 01**
NOTE:- Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities.

**Physiology**

1. **Blood**: Determination of Haemoglobin (Hb), ESR, RBC Count, WBC Count, DLC (Differential Leucocyte Count), Bleeding Time, Coagulation Time and Determination of blood groups.

**Histology**

1. Demonstration of preparation and staining of slides. Histological examination of slides, epithelium, connective tissues, muscle tissues, Organ system – Lung, appendix, Gall bladder, Stomach, Intestine, Heart, Artery, Vein, Lymphatic, etc.

**Recommended Books**

**Physiology**


**Histology**


2. Cardiovascular System:
   (a) Heart: Structure of Heart, Location of Heart, Blood Supply to Heart.
   (c) Blood Vessels: Main blood vessels arising & entering the heart. Types of blood vessels with examples.

3. Respiratory System: Name and structures of different parts of respiratory system and their inter-relationship.

4. Elementary System: Name and structure of different parts of elementary system and their inter-relationship.

5. Urinary System: Name and structure of organs of urinarystystem and their inter-relationship.

6. Reproductive System: Male and Female reproductive systems. Name, structure and association of the organs.

7. Endocrine System:
   (a) Pituitary gland, structure and relation to hypothalamus.
   (b) Thyroid gland, structure.
   (c) Adrenal gland, structure.

8. Nervous System:
   Introduction: Cells of Nervous System (Neuron), Accessory cells of NS Organisation of Nervous System:
   (b) Autonomic Nervous System: Sympathetic Nervous System and Parasympathetic Nervous System.

Recommended Books

319 **PHARMACEUTICAL MATHEMATICS (Theory)** Cr. Hr. 02

1. **ALGEBRA:**
   (b) Solution of Linear and Quadratic Equations. Equations reducible to Quadratic Form. Solution of simultaneous Equations.
   (c) Arithmetic, Geometric and Harmonic Progressions. Arithmetic, Geometric and Harmonic Means.
   (d) Permutations and combinations.
   (e) Binomial Theorem: Simple application.

2. **TRIGONOMETRY:** Measurement of Angles in Radian and degrees. Definitions of circular functions. Derivation of circular function for simple cases.

3. **ANALYTICAL GEOMETRY:** Coordinates on point in a plane. Distance between two points in a plane. Locus, Equations of straight line, Equation of Parabola, Circle and Ellips.


5. **INTEGRAL CALCULUS:** Concept of Integration. Rules of Integrations. Integrations of Algebric and Trignomatric functions by using different techniques.
Recommended Books

SECOND SEMESTER

302  PHARMACEUTICAL CHEMISTRY (Organic-II)
(Theory)  Cr. Hr. 03

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

1. Stereochemistry: Stereoisomerism, optical isomerism; Molecules with more than one chiral center. Geometrical isomerism, Resolution of racemic mixture. Conformational analysis.
4. Preparation and properties of medicinally important heterocyclic compounds such as: Pyrrol, Furan, Thiophene, Pyridine, Pyrimidine and Pyrazine.
5. Preparation and properties of heterocyclic compounds in which benzo-ring is fused with five and six membered ring containing one heteroatom; Indole, Quinoline and Isoquinoline.
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 like Benzoic acid, Aspirin, Acetanilide, Iodoform, Nitrophenol, 3-nitrophthalic acid, Benzhydrol, 2, 4-Dinitro-chlorobenzene.

Recommended Books

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 β-oxidation, Biosynthesis of fatty acids, neutral lipids and cholesterol.
(c) **Proteins and Amino acids:** Brief introduction to the digestion and absorption of proteins and amino acids, Metabolism of essential and non-essential amino acids, Biosynthesis and catabolism of Haemins and porphyrin compounds.

(d) **Bioenergetics:** Principles of bioenergetics. Electron transport chain and oxidative phosphorylation.

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

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

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

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

308  **PHARMACEUTICAL BIOCHEMISTRY-II**  
(Laboratory)  

**Cr. Hr. 01**

**NOTE:**- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. **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 including Sugar, Uric acid, Bilirubin, Cholesterol and Creatinine.

**Recommended Books**


310 **PHARMACEUTICS-II (PHYSICAL PHARMACY-II)**

(Theory)  Cr. Hr. 03

1. **DISPERSED SYSTEM:**
   (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: Adsorption techniques and processes of adsorption in detail.

2. **RHEOLOGY:**
   (a) Definition and Fundamental concept.
   (b) Properties contributing to rheological behaviour.
   (c) Graphic presentation of rheological data.

3. **RATE and ORDER OF REACTIONS.**

4. **KINETIC PRINCIPLES AND STABILITY TESTING: THEORETIC CONSIDERATIONS:** Degradation:
   (b) Chemical Factors: Complex chemical reactions. Oxidation-reduction, hydrolysis.
NOTE:— Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Determination of Emulsion systems. Determination of %age composition of solutions by specific gravity method. Determination of Partition-coefficient, surface tension, viscosity.

Recommended Books
3. Bentley’s Pharmaceutics, All India Traveler Book Seller, New Delhi, 1996.

Physiology

3. **SKIN**: Structure, Functions of skin, Temperature regulation by Skin.

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

   - **Pituitary hormones**: Growth Hormone, Prolactin, ACTH, TSH, ADH, Oxytocin. Acromegaly, Giantism, PanHypopituitarism.
   - **Thyroid Gland**: Thyroxin, Tri-iodothyronin, Format and functions of thyroid hormones. Hyperthroidism, Myxedema.
   - **Para thryoid Hormone**;
   - **Pancreatic Hormone**: Insulin, Glucagon, Diabetes mellitis.
   - **Adrenal Glands**: Mineralocorticoids, Glucocorticoids, Anabolic Steroids, Adrenalin, Nor-adrenalin, Cushing syndrome, Addison disease.

### Histology

1. Skin: Types of skin, Derivatives of skin including Nail, sebaceous glands, sweat glands and Hair follicles.
2. Lymphoid Tissue: General structure of Lymphoid organs: Lymph node, spleen, palatine tonsil and thymus.
3. Excretory system including Kidney, Ureter, and Urinary bladder.
4. Reproductive system: Male reproductive organs, (Testes, Genital tract). Female reproductive organs, (Ovary, and female genital tract).
5. Endocrine system: Pituitary gland, Adrenal gland, Thyroid gland, Parathyroid gland, Endocrine part of pancreas.

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**316 PHYSIOLOGY & HISTOLOGY-II (Laboratory) Cr. Hr. 01**

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

**Physiology**

1. **Eye**: Visual activity, far vision and near vision. Field of vision (Perimetry).
**Histology**
Demonstration of preparation and staining of slides. Histological examination of slides. Organ system – Skin, Spleen, Tonsil, thymus, Reproductive system, Endocrine system, etc.

**Recommended Books**

**Physiology**

**Histology**

**318 BIOSTATISTICS (Theory) Cr. Hr. 04**


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

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

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


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 Square Distributions.

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

**Recommended Books**

SECOND PROFESSIONAL

FIRST SEMESTER

401 PHARMACEUTICS-III (Pharmaceutical Preparations-I)  
(Theory)  
Cr. Hr. 03

1. Introduction: Dosage form. Ingredients


5. Solvents used in Pharmaceutical Preparations.


403 PHARMACEUTICS-III (Pharmaceutical Preparations-I)  
(Laboratory)  
Cr. Hr. 01

NOTE:- Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Preparation of simple syrup, Orange syrup, Ferrous sulphate syrup, Cod Liver oil Emulsion, Liquid paraffin Emulsion, Throat paint (Mandle’s paint), Boroglycerine glycerite, Tannic acid glycerine, Spirit ammonia aromatic, Spirit of Ethyl nitrite.  
(A minimum of 10n practicals will be conducted)
1. **Recommended Books**


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### 405 PHARMACOLOGY & THERAPEUTICS-I (General-I)

**Cr. Hr. 03**

1. **GENERAL PHARMACOLOGY**

   (a) **Introduction**: History, Pharmacology and its classification and Drugs and their sources
   
   (b) **Routes of drugs administration**: Advantages and disadvantages of Enteral Routes, Advantages and disadvantages of Parenteral Routes and Advantages and disadvantages of Topical Routes.
   
   (c) **Pharmacokinetics**: Drug solubility and passage of drugs across the body membranes, Plasma concentration of drugs and various factors affecting it (Absorption and factors influencing the rate of absorption (GIT and other routes) of drugs, Distribution and factors influencing the rate of distribution of drugs, Biotransformation and factors influencing the rate of biotransformation of drugs, Excretion, channels of excretion and factors influencing the rate of excretion of drugs), Definition of (Bioavailability & Bioequivalence, Therapeutic Index, Plasma Half Life ($t_{1/2}$), Dose-Response Curve, Area Under Curve, Volume of Distribution.
   
   (d) **Pharmacodynamics**: Drug receptors and theories, Mechanisms of drug action, Specificity of drug action and Factors modifying the action & dosage of drugs.

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 Non-catecholamines.
   
   (d) Sympathetic antagonist drugs: Adrenergics Nerve Blockers, Adrenoceptor antagonists (Alpha-adrenergic blockers and Beta-adrenergic blockers).
(e) Parasympathetic (Cholinergic) agonists and Anticholinesterase inhibitors.
(f) Parasympathetic antagonists.
(g) Drugs acting on Ganglia (Ganglian stimulants and Ganglion blockers).
(h) Neuromuscular blocking drugs.

3. **DRUGS ACTING ON GASTROINTESTINAL TRACT:**
   (a) Emetic.
   (b) Anti-emetics.
   (c) Purgatives: Bulk forming purgatives, Lubricant purgatives, Irritant purgatives and Saline Purgatives.
   (d) Anti-diarrheal Agents.
   (e) Treatment of Peptic & Dudenal Ulcers: Antiacids, H2-Receptor Antagonists, Antimuscarinic Agents, Proton Pump Inhibitors, Gastrin Receptor Antagonist and Cytoprotective agents.
   (f) Drug treatment of chronic inflammatory diseases of bowel.
   (g) 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.

**407 PHARMACOLOGY & THERAPEUTICS-I (General-I) (Laboratory) Cr. Hr. 01**

**NOTE:-** Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Preparation of 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.
(Note: A minimum of 10 practicals will be conducted)

Recommended Books
1. Goodman Gillman, Pharmacological basis of therapeutics. McGraw-
2. Winguard and Brody, Human Pharmacology, Mosby Year Book,
4. R S Satorkar and S D Bhandarkar, Pharmacology and
5. J D Tripathy, Essential of Medical Pharmacology, Japees Brother, New
   1993.
    University, Peshawar.
    International Inc, New Jersey.

409 PHARMACOGNOSY-I (Theory) Cr. Hr. 03

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
Families | Crude Drugs
---|---
b. Papaveraceae Papaver Somniferum, Sanguinaria, Canadensis.
c. Leguminosae Acacia, Glycyrrhiza, Senna, Cassia, Tamarind.
d. Umbelliferae Fennel, Carum, Coriander, Conium, Asafoetida.
e. Apocynaceae Rauwolfia, Catharanthus.
f. Solanaceae Belladonna, Hyoscymus, Stramonium Capsicum.
g. Scrophulariaceae Digitalis, Verbascum (Mullien).
h. Labiatae Peppermint, Thyme, Spearmint, Salvia, Ocimum.
i. Liliaceae Garlic, Colchicum, Aloe.
j. Zingiberaceae Ginger, Curcuma.

3. GROWTH REGULATORS: General account with special reference to Auxins, Gibberellins, Abscisic acid, Cytokinins and Ethylene.

411 PHARMACOGNOSY -I (Laboratory) Cr. Hr. 01

NOTE:- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Introduction of the entire and broken parts of the plant drugs (Macro and organoleptic characters).
(Note: A minimum of 10 practicals will be conducted)

Recommended Books

413 PHARMACEUTICAL MICROBIOLOGY-I (Theory) Cr. Hr. 03
**Note:** The topics will be taught with special reference to their Pharmaceutical Applications.


2. **ORGANISMS:**
   - 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).

**413 PHARMACEUTICAL MICROBIOLOGY-I (Theory) Cr. Hr. 03**

**NOTE:** Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Preparation of general and selective media and culturing of micro-organisms. Total and viable counts of microorganism. Morphological and selective biochemical characteriz-ation 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.
Recommended Books

417 PAKISTAN STUDIES (Theory) Cr. Hr. 03
As per syllabi of B.A/B.Sc. classes, approved by the respective University.

SECOND SEMESTER

402 Pharmaceutics-IV (Pharmaceutical Preparations-II) (Theory) Cr. Hr. 03


3. SUPPOSITORY AND VAGINAL SUPPOSITORIES: Semi-solid Preparations, Suppositories bases, preparation, packaging and storage, Solutions/Anemas.
4. **AEROSOLS, INHALATIONS AND SPRAYS:** Aerosol: Principle, container and valve assembly, Propellants, filling, testing, packaging, labeling and storage.


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

7. A brief introduction to oral hygiene products.

404 **Pharmaceutics-IV (Pharmaceutical Preparations-II)**  
(Laboratory)  
Cr. Hr. 01

**NOTE:-** Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Prepartion of Methyl salicylate ointment, Sulpher ointment, Calamine lotion, Iodine tincture, Preparations of oral hygiene products, Poultice of Kaolin, Effervescent granules, Distilled Water for injections.  
(A minimum of 10n practicals will be conducted)

**Recommended Books**

1. AUTACOIDS AND THEIR ANTAGONISTS:
   Histamine and Antihistamines, Serotonin and Serotonin Antagonists and Other Autocoids

2. DRUGS ACTING ON RESPIRATORY SYSTEM:
   (a) Drugs used for cough (Antitussives, Expectorants and Mucolytic Agents).
   (b) Drug treatment of Bronchial Asthma (Bronchodilators, Cromoglycate, Nedocromil, Corticosteroids & other Anti-inflammatory drugs and Muscarinic receptor antagonists)

3. DRUGS ACTING ON CARDIO-VESUCULAR SYSTEM:
   (a) Angina pectorus and its drug treatment.
   (b) Congestive heart failure & its treatment.
   (c) Antiarrhythmic drugs.
   (d) Agents used in Hyperlipidemia.
   (e) Coagulants and Anticoagulants.
   (f) Antihypertensives.
   (g) Diuretics.

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

5. ANTI-ANAEMIC 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.
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. To demonstrate 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

8. Lipponcott, Pharmacology, Lippincot William & Willkin, USA, 2001
10. Prof Dr A Qayum, Fundamentals of Experimental Pharmacology.
1. **ALLERGENS AND ALLERGENIC PREPARATION:** Introduction, case history, skin test, treatment of allergy, inhalant, ingestant, injectant, contactant, infectant and infestant allergens. Mechanism of allergy.

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

3. **POISONOUS PLANTS:** General introduction of poisonous plants with special reference to Pakistan.

4. **PESTICIDES:** Introduction. Methods of controlling pests with special reference to natural methods.

**412 PHARMACOGNOSY-II (Laboratory)  Cr. Hr. 01**

**NOTE:**- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Microscopic examination of powders and sections of plant drugs.

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 various hilly areas of the country.

**Recommended Books**


**414 PHARMACEUTICAL MICROBIOLOGY-II**
Note:- The topics will be taught with special reference to their Pharmaceutical Applications.

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


416 **PHARMACEUTICAL MICROBIOLOGY-II (LABORATORY)**

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. Sterilization of Glassware and pharmaceutical products by various methods. Microbiological assays of: Antibiotics and vitamins.

**Recommended Books**


418 ISLAMIYAT (Theory) Cr. Hr. 03

As per syllabi of B.A/B.Sc. classes, approved by the respective University.

THIRD PROFESSIONAL

FIRST SEMESTER

501 PATHOLOGY (Theory) Cr. Hr. 03

1. SCOPE OF PATHOLOGY & CONCEPT OF DISEASES:


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

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

503 PATHOLOGY (Laboratory) Cr. Hr. 01

Study of Pathological Slides of various Pathological Conditions
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 test, Renal function test, Tests for endocrine
abnormalities, Biopsies and cytologic techniques.

Recommended Books
1. Kumar Cotran Robins, Basic Pathology, 6th Ed., W B Saunders
2. Walters and Israel, General Pathology, Churchill Livingstone, London
3. Peter S Macfarlane, Robin Reid, Robin Collander, Pathology Illustrated,
5. Walter G B, General Pathology, Churchill Livingstone, New York,
   1996.

505 PHARMACOLOGY & THERAPEUTICS (Systemic
Pharmacology) (Theory) Cr. Hr. 03

1. DRUGS ACTING ON CENTRAL NERVOUS SYSTEM
   (a) CNS – Depressants: Hypnotic & Sedatives and Analgesics
   (Narcotic Analgesics and opioid antagonists, Analgesic,
   Antipyretic and Anti-inflammatory drugs [NSAID] including
   Disease-modifying antirheumatic drugs and Drug treatment of
   Gout)
   (b) CNS – Stimulants: Cerebral Stimulants, Medullary stimulants,
   Spinal Cord Stimulants, Antidepressants, Psychotomimetic or
   Hallucinogenics, Psychotherapeutic Agents (Anxiolytics and
   Antipsychotics), Drug treatment of Epilepsy and Drug treatment of
   Parkinsonism and other movement disorders.

2. ANAESTHETICS
   (a) Anaesthesia and its clinical importance.
   (b) General Anaesthesia, Mechanism of action and its application.
   (c) General Anaesthetics.
   (d) Local Anaesthetics.
   (e) Spinal Anaesthesia and drug used.
   (f) Techniques of Local Anaesthesia.
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.

507 PHARMACOLOGY & THERAPEUTICS (Systemic Pharmacology) (Laboratory) Cr. Hr. 01

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

Recommended Books

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


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509 **PHARMACOGNOSY-III (Theory)**  
Cr. Hr. 03

1. **SEPARATION AND ISOLATION OF PLANT CONSTITUTIONS**: An introduction to chromatography and chromatographic techniques e.g. Adsorption Chromatography and Partition Chromatography.

2. **CARBOHYDRATES**: Introduction of carbohydrate.  
   (a) **Sucrose and Sucrose containing drugs**: Sucrose, Dextrose, Liquid glucose, Fructose, Lactose, Xylose, Caramel, Honey, Starch, Inulin, Dextrine etc.  
   (b) **Cellulose and Cellulose Derivatives**: Purified cotton, Powdered cellulose, Microcrystalline cellulose, Methyl cellulose, Sodium Carboxy-methyl cellulose.  
   (c) **Gums and Mucilages**: Traganth, Acacia, Sodium Alginate, Agar, Pectin.

3. **GLYCOSIDES**: Introduction, classification, chemistry 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.

4. **TANNINS**: Introduction, classification, properties and chemical identity tests of Tannins and Tannin containing compounds. Detailed study of Hammamelis, Catechu and Nut Galls.

5. **LIPIDS**: Introduction. Detailed study of:
(a) Fixed Oils: Castor oil, cotton seed oil, olive oil, peanut oil, sunflower oil, corn oil, coconut oil, Almond oil, Linseed oil, Mustard oil, Sesame oil and soybean oil.
(b) Fats and Related Compounds: Theobroma oil and Lenolin.
(c) Waxes: Bees wax, carnauba wax, spermaceti and Jojoba oil.

511 PHARMACOGNOSY-III (Laboratory) Cr. Hr. 01

NOTE:- Practicalss 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.

Recommended Books

513 PHARMACEUTICAL CHEMISTRY-III (Instrumentation-I)
(Theory) Cr. Hr. 03

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

Theory, Instrumentation and Pharmaceutical Applications of the following Spectroscopic Methods
3. Flame Photometry.
6. NMR Spectroscopy.
7. UV/Visible Spectroscopy.

515 PHARMACEUTICAL CHEMISTRY-III (Instrumentation-I) (Laboratory) Cr. Hr. 01

NOTE:- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. Determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques.

Recommended Books

517 PHARMACEUTICS-V (Dispensing Pharmacy) (Theory) Cr. Hr. 02

1. Basic Principles of Compounding and Dispensing Including: Weights and Measures, Calculations for compounding and Dispensing, 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.

4. Classical dosage Forms.

5. I.V. Admixtures.


519 PHARMACEUTICS-V (Dispensing Pharmacy) (Laboratory) Cr. Hr. 01

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

1. Mixtures: Dispensing of simple mixtures containing soluble substances only, mixtures containing diffusable substances, indiffusable substances and mixtures forming precipitate.

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

3. Incompatibility: Practical Importance of Incompatibilities.

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

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

Recommended Books
2. Hussa’s Dispensing.

SECOND SEMESTER
502 COMPUTER AND ITS APPLICATIONS IN PHARMACY (Theory)  
Cr. Hr. 03

1. Fundamentals basic concept of computers  
   History of Data Processing, Types of Computers, Components of a  
   Computer, Computer System and Business Computer System, Backing  
   Storage Devices, Unit of Memory, Viruses and Anti-viruses Issues.
2. System Analysis and Design  
   What is a System? Steps in system life cycle, Data Gathering and Data  
   Analysis, Designing a New System, Development and Implementation of  
   New System, Documentation.
3. Data Processing  
   Data Processing, The Data Processing Cycle, The Collection and  
   Computing of data, Manual collection of data, The main 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.
4. Data Communication  
   Applications of Data Communication, Components of a data  
   communication system, Rate of data Transmission, Computer Networks,  
   Network Topology, Gateway, E-mail/Internet concepts.

504 COMPUTER AND ITS APPLICATIONS IN PHARMACY  
(Laboratory)  
Cr. Hr. 01

1. Internet and E-mail  
   Internet and Microsoft Internet Explorer 5, Addresses, Links and  
   Downloading, Searching the Internet, E-mail and Newsgroups,  
   Favorites, security and Customizing Explorer.
2. Web Page Development  
   Introduction to Front-page, Creating a First Web site, Basic  
   Formatting Techniques, Manipulating Tables within Front-page,  
   Front-page, Picture and Multimedia, Hyper linking, Bookmarks and  
   Image Maps, Introducing Front-page “components”, Front-page and  
   Frames, Managing your Web, Good site design, Publishing and  
   publicizing.
3. Complete Statistical Package like SPSS.
4. Languages  
   At least two prevailing languages will be taught.

Recommended Books
1. Elias M System Analysis. Award Galgotia Publications, New Delhi,  
   1989.

506 PHARMACOLOGY AND THERAPEUTICS-IV (Systemic Pharmacology-II (Theory))

**Cr. Hr. 03**

1. **CHEMOTHERAPY**
   (a) Classification of drugs.
   (b) Antimicrobials: Sulphonamides, Antivirals, Antiprotozoals (Treatment of Malaria and Treatment of Amebiasis), Antifungals, Anthelmintics, Anti-neoplastic and Immunosuppressive drugs, Drug treatment of Leprosy and Antibiotics (Penicillins, Cephalosporins, Aminoglycosides, Tetracyclines, Chloramphenicol, Macrolides, Quinolones and Miscellaneous Antibiotics).
   (c) Antihypertensive Drugs.
   (d) Steroids and Antisteroid drugs.

2. **HORMONES, ANTAGONISTS AND OTHER AGENTS AFFECTING ENDOCRINE FUNCTION**
   (a) Endocrine function and dysfunctions.
   (b) Drug used for therapy of Diabetes Mellitus: Insulins and Oral Hypoglycemic agents.
   (c) Corticosteroids.
   (d) Thyroid hormone and anti-thyroid drugs.

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

**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.

**508 PHARMACOLOGY AND THERAPEUTICS-IV (Systemic Pharmacology-II) (Laboratory)**

**Cr. Hr. 01**

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

1. To identify and differentiate the effects of unknown drug on human and the nerve plexus of frog.
2. To demonstrate the effects of Acetylcholine on the Rectus abdominus muscle of frog and competitive.
3. Pharmacological antagonism by Neuromuscular blocking agent e.g. Gallamine.
4. To identify the unknown drug by performing pharmacological competitive antagonism on Rectus.
5. Abdominus muscle of Frog.
6. To study the anti-coagulant effects of Heparin and oral anti-coagulants on Rabbits.
7. To identify the unknown anti-coagulant drug using Rabbits.
8. To demonstrate the graded Dose-Response curve of Acetylcholine on Rabbit intestine.
9. To identify unknown concentration of Acetycholine from graded Dose-Response curves.

**Recommended Books**


**510 PHARMACOGNOSY-IV (Theory) Cr. Hr. 03**

1. **VOLATILE OILS (ESSENTIAL OILS):** Introduction, significance, methods of obtaining volatile oils, chemistry and classification of:
   (a) **Hydrocarbon volatile oils:** Cubeb and Terpentine 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 RESIN COMBINATION:** Introduction, properties and difference between glycoresins, oleoresins, oleo-gum resins and balsams.
   (a) **Resins:** Rosin, Cannabis.
   (b) **Glycoresins:** Podophyllum, Jalap, Ipomoea, Colocynth.
   (c) **Oleoresins:** Terpentine, Capsicum, Ginger.
   (d) **Oleo-gum resins:** Asafoetida, Myrrh.
   (e) **Balsams:** Storax, Peruvian balsam, Tolu balsam, Benzoin.

3. **ALKALOIDS:** Introduction, Properties, Classification, Function of alkaloids in plants, Methods of extraction and identification tests.
   (a) **Pyridine — Piperidine Alkaloids:** Areca nut, Lobelia, Tobacco.
   (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. **TUMOUR INHIBITORS FROM PLANT:** Detailed study of various antitumour agents isolated from plants.

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**512 PHARMACOGNOSY-IV (Laboratory) Cr. Hr. 01**

**NOTE:**- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Isolation and separation of active constituents of crude drugs by paper and thin layer chromatography.

**Recommended Books**


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**514 PHARMACEUTICAL CHEMISTRY-IV (Instrumentation) (Theory) Cr. Hr. 03**

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

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

2. **ELECTRO CHEMICAL METHODS:** Potentiometry, Polarography and Radiochemical Techniques.
3. **DIFFERENTIAL SCANNING CALORIMETRY.**

516 **PHARMACEUTICAL CHEMISTRY-IV (Instrumentation)**

*(Laboratory)*

Cr. Hr. 01

**NOTE:-** Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the requirements, e.g. Determination of the Purity and Composition of the unknown drugs by using at least each of the above techniques.

**Recommended Books**

1. DEFINITIONS AND BACKGROUND.

2. PUBLIC HEALTH AND COMMUNITY PHARMACY: Epidemiology & its Control, Preventive Health (EPI & CDC), Family Planning and Health Policy & National Drug Policy.

3. PATIENT ASSESSMENT.

4. MEDICAL COMPLICATION OF DRUG TAKING: General and Socio-economic Aspects.

5. PATIENT PHARMACIST COMMUNICATION.

6. PATIENT EDUCATION AND COUNSELLING.

7. CONTROL OF DRUG ABUSE AND MISUSE.

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

Recommended Books
FOURTH PROFESSIONAL

FIRST SEMESTER

601 PHARMACEUTICS-VII (Hospital Pharmacy-I)
(Theory) Cr. Hr. 03

1. INTRODUCTION
   (a) Role of Pharmacist in Hospital.
   (b) Minimum standards for pharmacies in Institutions/Hospitals.
   (c) Research in Hospital Pharmacy.

2. HOSPITAL AND ITS ORGANIZATION
   (a) Classification of Hospitals.
   (b) Organizational Pattern.
   (c) Administration.
   (d) Clinical Departments.
   (e) Nursing, Dietectic, 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 & Role of Pharmacist.
   (d) Benefits and problems.
   (e) Keeping up-to-date Formulary.
   (f) Contraceptives.

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
    (a) Medication error.
    (b) Evaluation & Precautions of Medication Error.
    (c) Role of Pharmacist in Controlling Medication Error.

Recommended Books

603 PHARMACEUTICS-VIII (Clinical Pharmacy-I) (Theory) Cr. Hr. 03

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

2. PATIENT PROFILE:
   (a) Patient disease profile.
   (b) Taking case History.
   (c) Drug Profile of 25 Drugs (Adrenaline, Aminoglycosides, Anti TB Drugs, Antiepileptics, Atropine, Benzodiazepines, Cephalosporins, Chlorpheniramime, Cimetidine, Digoxin, Dobutamine, Dopamine, Fluroquinolone, Frusemide, Lactulose, Macrolides, Metoclopramide, Morphine/Pethidine, Nifedipine, NSAIDS, ORS, Penicillins, Prednisolone, Salbutamol, Vancomycin)

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

**Recommended Books**


607  **PHARMACEUTICS-IX (Industrial Pharmacy-I)**

(Theory)  
**Cr. Hr. 03**

1. **MASS TRANSFER.**

2. **HEAT TRANSFER.**

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

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

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

7. **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).

8. **SAFETY METHODS IN PHARMACEUTICAL INDUSTRY:**
   (a) Mechanical, chemical and fire hazards problems.
   (b) Inflammable gases and dusts.

609 **PHARMACEUTICS-IX (Industrial Pharmacy-I)**
   (Laboratory)         Cr. Hr. 01

**NOTE:**- Practicals of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Manufacture of Tablets by Wet Granulation Method, by Slugging and by Direct Compression. Coating of Tablets (Sugar Coating, Film coating and Enteric Coating). Clarification of liquids by various processes. Size Reduction. Homogenization.

**Recommended Books**
1. DEFINITIONS AND TERMINOLOGY:
   Biopharmaceutics, Generic Equivalence, Bioavailability, Bioequivalence, Drug Disposition, Therapeutics, Pharmacokinetics, Biotransformation and Therapeutic Equivalents.

2. GASTRO-INTESTINAL ABSORPTION AND PHYSICO-CHEMICAL CONSIDERATIONS.
   Forces which help in transmembrane movements, pH Partition Theory, Lipid Solubility and Factors affecting Bioavailability.

3. BIOAVAILABILITY STUDIES:
   Purpose, Relative and Absolute Bioavailability, and Determination of Bioavailability.

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

5. MULTIPLE DOSAGE REGIMIN.

6. INTRAVENOUS INFUSIONS.

7. BIOPHARMACEUTICAL AND PHARMACOKINETIC ASPECTS IN DEVELOPING A DOSAGE FORM.

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. 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.

Recommended Books
10. Albert P Li, **Invitro approaches for evaluation of drug efficacy and toxicity**, CRC Press LLC, USA, 2004.

615 **PHARMACEUTICS-XI (Pharmaceutical Quality Management-I) (Theory)**

Cr. Hr. 03

1. **SCOPE**
   (a) An understanding of the testing, quality control programme and methods adopted in a pharmaceutical industry, dosage form control, process control, testing program and methods, physical, chemical and biological tests and specifications, statistical quality control.
   (b) General understanding of Total Quality Assurance and measures to adopt Quality Assurance.

2. **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 determiniation and application in the Quality Control of Pharmaceuticals, Weight per ml and Assay of active ingredients.
4. **EVALUATION OF SUSTAINED ACTION PRODUCTS (TABLETS & CAPSULES):**  
   Stability of viability rate during storage and In-vitro & In-vivo evaluation of sustaining action.

5. **QUALITY CONTROL OF SUPPOSITORIES**  
   Disintegration test, Uniformity of weight, Assay of active ingredients, Liqefaction time test and Breaking test.

6. **QUALITY CONTROL OF STERILE PRODUCTS (PARENTERALS)**  
   Leaker’s test, Clarity test, Pyrogen test for parenterals and other sterile preparations and Assay for active ingredients.

**617 PHARMACEUTICS-XI (Pharmaceutical Quality Management-I) (Laboratory) Cr. Hr. 01**

**NOTE:** Practical of the subject shall be designed from time to time on the basis of the above mentioned theoretical topics and availability of the facilities, e.g. Assay of various spirits, tinctures, extracts, syrups and elixirs, Assay of Ointments and suppositories, Assay of tablets and capsules, Test for alkalinity of glass, Determination of alcohol contents in the Pharmaceutical preparations and Pyrogen test.

**Recommended Books**


**SECOND SEMESTER**

**602 PHARMACEUTICS-VII (Hospital Pharmacy-II)**  
(Theory)  
Cr. Hr. 03

1. MANUFACTURING BULK AND STERILE.

2. THE PHARMACY-CENTRAL STERILE SUPPLY ROOM.

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

4. ROLE OF PHARMACISTS 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).
13. COMMON KNOWLEDGE OF ABOUT 100 DRUGS REGISTERED BY MINISTRY OF HEALTH, GOVERNMENT OF PAKISTAN.

**Recommended Books**


604  **PHARMACEUTICS-VIII (Clinical Pharmacy-II) (Theory)**  
**Cr. Hr. 03**

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

2. **ADVERSE DRUG REACTIONS:**  
   Adverse Drug Reactions and Side Effects: Classification, Excessive pharmacological response, Idiosyncrasy, Secondary pharmacological effects, Allergic drug reactions, General toxicity, Toxicity following drug withdrawal, Detection, reporting & Management of ADR.

3. **DRUG INDUCED DISEASES.**

4. **COMPUTERS IN CLINICAL PHARMACY:**

5. **UTILIZATION OF CLINICAL DRUG LITERATURE:** Introduction, Drug literature selection, Drug literature evaluation and Drug literature communication.
Clerkship in the Clinical setting. A project related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.

**Recommended Books**


**608 PHARMACEUTICS-IX (Industrial Pharmacy-II) (Theory)**

Cr. Hr. 03

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

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

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

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

5. **STANDARDIZATION OF PHARMACEUTICALS:**

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

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

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

610 **PHARMACEUTICS-IX (Industrial Pharmacy-II)**
   *(Laboratory)*

   **Cr. Hr. 01**

   **NOTE:**- Practicalts 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. Ampoule filling, sealing and sterilization clarity and leakage tests in injectables.

**Recommended Books**

612 **PHARMACEUTICS-X (Biopharmaceutics-II)**  
(Theory)  
(Cr. Hr. 03)

1. **INTRODUCTION TO PHARMACOKINETICS:**  
   Determination through plasma drug level studies. Application of pharmacokinetics in clinical situations.

2. **CONCEPT OF COMPARTMENT (S) MODELS:**  
   One compartment open model. Two compartment open model. Three compartment open model and Non-compartmental method of analysis.

3. **BIOLOGICAL HALF-LIFE AND VOLUME OF DISTRIBUTION:**  
   Concept and Methods of Determination.

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

5. **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, Mammary excretion, Skin excretion and Genital excretion.

6. **PROTEIN BINDING:**  
   Determination of plasma protein binding and Clinical significance of drug-protein binding.
7. APPLICATIONS OF PHARMACOKINETICS AND BIOAVAILABILITY IN CLINICAL SITUATIONS.

8. APPLICATIONS OF PHARMACOKINETICS IN DISEASE STATES.

614 PHARMACEUTICS-X (Biopharmaceutics-II) (Laboratory) Cr. Hr. 01

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

1. Plasma level-time curve: Determination of Pharmacokinetic parameters.
2. Determination of plasma protein binding.
3. Urinary sampling techniques.
4. In Laboratory animals. In humans. Renal excretion of drugs or drug disposition.

Recommended Books
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 DETERMIANTION**: 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, Puriification of Alkaloids and determination of alkaloids.


5. **GENERAL KNOWLEDGE OF APPENDICES ATTACHED TO B.P., BPC, AND USP.**

6. **STATISTICAL INTERPRETATION OF QUALITY CONTROL CHARTS DURING MANUFACTURING PROCESSES.**

**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. 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.
Recommended Books

1. INTRODUCTION TO MEDICINAL CHEMISTRY:
   Chemical constitution and biological activity: (Receptor, Theory, Structure Activity Relationships (SAR) and Drug Metabolism).

2. CLASSIFICATION OF SYNTHETIC DRUGS:
   Drug Design and recent approaches to the synthesis of drugs (a brief concept of methods and reactions of synthesis of various drugs).

3. GENERAL PROPERTIES, CHEMISTRY (General methods of determination, the structure & isolation from natural source), BIOLOGICAL ACTION, STRUCTURE ACTIVITY RELATIONSHIP AND THERAPEUTIC APPLICATIONS OF THE FOLLOWING:
   a) Alicyclic Compounds: Cyclopropane, Terpenes, Citral, Pinene, Camphor, Menthol, Carotenes.
   b) Alkaloids: Atropine, Morphine and related compounds (Codeine, Thebaine), Ergotamine, Reserpine, Ephedrine.
   c) Vitamins: Water Soluble Vitamins (B1, B2, B6, B12, Folic acid, Nicotinic acid, Biotin, Pantothenic acid and Ascorbic acid) Fat Soluble Vitamins (A, D, E, and K).
   d) Hormones: Steroidal Hormones (Testosterone, Progesterone, Estrogen, Aldosteron and Cortisol), Proteinous Hormones (Insulin, Glucagon, Oxytocin and Vassopressin).
   e) Anti-neoplastic Agents: Tamoxifen, Fluorouracil, Mercapturine, Methotrexate and Vincristine.
   f) Sedatives and Hypnotics: Benzodiazepines, Barbiturates, Paraldehyde, Glutethimide, Chloral hydrate, and alcohols.
   g) Anaesthetics: Local anaesthetics (Procaine, Lignocaine, Euaine, Cocaine and Benzoaine), General anaesthetics (Cyclopropane, Halothane, Nitrous oxide, Chloroform, Thiopental Sodium, Ketamine, Methohexital, Thioamylal Sodium, Fantaryl Citrate, Tribromo ethanol).
   h) Analgesics and Antipyretics: Paracetamol, Salicylic acid analogues, Quinolines derivatives, Pyrazolone and Pyrazolodiones, N-arylanthranilic acids, Aryl and heteroaryl acetic acid derivatives.
**703  PHARMACEUTICAL CHEMISTRY-V (Medicinal Chemistry-I) (Laboratory)  Cr. Hr. 01**

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

1. Estimation of functional groups; Carboxylic, Hydroxy, Amino and Nitro groups; Determination of Molecular weights of Organic Compounds.
2. 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.

**Recommended Books**

**705  PHARMACEUTICS-XVII (Clinical Pharmacy-III)  (Theory)  Cr. Hr. 03**

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

2. **INTRODUCTION TO ESSENTIAL DRUGS:** Criteria for selection, Usage and Advantages.

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

4. **DRUG ABUSE & MISUSE.**
5. **PRACTICAL PHARMACOKINETICS**: Therapeutic Drug Monitoring of Digoxin, Theophylline, Gentamycin, Lithium, Phenytoin, Cabamazepine, Phenobarbitone, Primidone, Walparic Acid, Cyclosporins and Vancomycin.

6. **PHARMACOECONOMIC STUDIES**.

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**707 PHARMACEUTICS-XVII (Clinical Pharmacy-III) (Laboratory) Cr. Hr. 01**

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

**Recommended Books**


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**709 PHARMACEUTICS-XVIII (Pharmaceutical Technology-I) (Theory) Cr. Hr. 03**
1. **PRINCIPLES OF PHARMACEUTICAL FORMULATION AND DOSAGE FORM DESIGN:** Product Formulation, Need for Dosage Form and Preformulation Studies.

2. **FORMULATION DEVELOPMENT:** Pharmaceutical Aerosoles, Ophthalmic Preparations, and Parenteral Preparations.

3. **ADVANCED FORMULATION TECHNIQUES:** Development of a formulation methodology and flow plan for the new product. New technologies in drug delivery system.

4. **NOVEL DRUG DELIVERY SYSTEMS:**
   a) Introduction to the Drug Carrier: Liposomes, Niosomes and Biodegradable polymers.
   b) Active & Passive Drug Delivery System.
   c) Other Novel GIT Systems.

**711 PHARMACEUTICS-XVIII (Pharmaceutical Technology-I) (Laboratory) Cr. Hr. 01**

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

**Recommended Books**

713 PHARMACEUTICS-XIX (Forensic Pharmacy-I) (Theory) Cr. Hr. 03

STUDY OF DRUG LAWS:
(a) The Drugs Act 1976 and rules framed thereunder.
(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
3. The Poisons Act, 1919.
4. The Dangerous Drugs Act 1930.
5. The Factory Law 1934.

713 PHARMACEUTICS-XX (Pharmaceutical Management & Marketing-I) (Theory) Cr. Hr. 03

1. MANAGEMENT:
   b) Types and Functions of Managers.
   c) Planning: Purpose and types of Planning, Steps in Planning.
   d) Organizing.
   e) Management Control Systems

f) Motivation.
g) Innovation and creativity.
h) Communication.

2. PRODUCTION MANAGEMENT:
(a) Material Management.

Recommended Books

SECOND SEMESTER

702 PHARMACEUTICAL CHEMISTRY-VI (Medicinal Chemistry-VI) (Theory) Cr. Hr. 03

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

1. GENERAL PROPERTIES, CHEMISTRY, BIOLOGICAL ACTION, STRUCTURE ACTIVITY RELATIONSHIP AND THERAPEUTIC APPLICATIONS OF THE FOLLOWING:
(a) Anti-septics: Phenols and related compounds, Halogens and Halogen compounds, Aromatic acid and esters, Dyes, Nitrofuran derivatives, Formaldehyde and its derivatives, Mercurochrome and Thiomersal.
(b) Sulphonamides: Prontosil, sulphanilamide, Sulphapyridine, sulphadimidine, Sulfamethoxazole, Sulfadiazine and Sulfafurazole.
(c) Antimalarials: 4-Aminoquinolines, 8-Aminoquinolines, 9-Amino acridines, Biguanides, Pyrimidine analogues, Mefloquine and Cinchoha alkaloids.
(d) Anthelmintics: Phenols and related compounds, Piperazine derivatives, Thiabendazole, Mebendazole and Pyrantal.
(e) Diuretics: Mercaptomerin, Meralluride, Thiazides, Sprironolactone, Theophylline, Furosemide, Acetazolamide, Ethacrynic acid and Triameterene.

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

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

(h) Immunosuppressant Agents: Azathioprine and Cyclosporin.

2. ANTIBIOTICS:
Penicillins, Cephalosporins, Streptomycin, Chloramphenicol, Tetracyclines, Kanamycin and Erythromycin.

3. 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.

704 PHARMACEUTICAL CHEMISTRY-VI (Medicinal Chemistry-VI) (Laboratory) Cr. Hr. 01

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


2. Inorganic Preparations.

Recommended Books
PHARMACEUTICS-XVIII (Clinical Pharmacy-IV)

(Theory) Cr. Hr. 03

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

2. ROLE OF CLINICAL PHARMACIST IN COMMUNITY PHARMACY.

3. CLINICAL THERAPEUTICS:
   (b) Basic introduction of some clinical situations, their clinical features, etiology, pathophysiology and treatment of causes: Common Cold, Pharyngitis and Tonsilitis, Pneumonia, Tuberculosis, Diarrhea, Malaria, Meningitis, Tetanus, Typhoid Fever, Measles, Rabies, AIDS, Congestive cardiac failure, Conjunctivitis, Anaemia, Gout, Asthma, Ulcer, Diabetes mellitus, Hypertension, Hepatitis, Dermatology (Scabies, Fungal diseases).

4. CLINICAL TOXICOLOGY:
   (a) General information. Role of pharmacist in treatment of poisoning and general management of poisoning & overdosage. Role and Status of Poison Control Centre.
   (b) Antidotes and their mechanism of action

5. SAVE INTRAVENOUS THERAPY & HAZARDS OF INTRAVENOUS THERAPY.

6. 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.

PHARMACEUTICS-XVIII (Clinical Pharmacy-IV)

(Laboratory) Cr. Hr. 01
Clerkship in the Clinical setting. A project related to Clinical Pharmacy Practices will be completed by the students and will be evaluated by the external examiner.

**Recommended Books**

1. MODIFIED DRUG RELEASE DOSAGE FORM:
The concept of sustained release, First order release approximation, 
Multiple dosing, Implementation of designing, Approaches based upon 
dosage form modification, Product evaluation and testing, Matrices 
tablets, Control release technology, Microencapsulation, Method of 
particle coating and Instrumentation in granule manufacturing.

2. PHARMACEUTICAL BIOTECHNOLOGY:
Biotechnological aspects in the product development, Fundamentals of 
Genetic Engineering and its Application in Medicine, Principle, 
Synthesis and Application of Monoclonal, Antibodies, Introduction to 
Gene therapy, Immobilized Enzymes and their application in Medicine, 
General Principle and Methods of Microbial Assay.

NOTE:- Practicalities 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. 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, Taylor & Francis, 
2. Joseph R Robinson Controlled drug delivery, Marcel & Dakker Inc, 
3. T V Ramabhadran, Pharmaceutical design and development, Ellis 
4. M E Aulton, Pharmaceutics: Science of Dosage Forms Design, 
6. John A Bontempo, Development of biopharmaceutical parenteral 
7. N K Jain, Controlled and Novel drug delivery, CBS Publishers & 
8. Ansel, Pharmaceutical Dosage Form in Drug Delivery System, Lee & 

714 PHARMACEUTICS-XX (Forensic Pharmacy-II) (Theory) Cr. Hr. 01

2. THE DANGEROUS DRUGS ACT, 1930.
3. THE FACTORY LAW 1934.
4. SHOPS AND ESTABLISHMENT ORDINANCE, 1969 WITH RULES.
5. THE POISONS ACT, 1919.

Recommended Books
2. The Pharmacy Act, 1967
3. The Poisons Act, 1919
4. The Dangerous Drugs Act, 1930
5. The Factory Law, 1934
6. Shop and Establishment Ordinance, 1969

716 PHARMACEUTICS-XXI (Pharmaceutical Management & Marketing-II) (Theory) Cr. Hr. 03
1. **MARKETING MANAGEMENT:**
   Marketing channels, Promotion and Advertising and Salesmanship.

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

3. **PHARMACY LAYOUT DESIGN:**

**Recommended Books**


CONDENSE COURSES FOR B-PHARMACY

**Theory**
Anatomy
Biopharmaceutics
Biostatistics
Clinical Pharmacy
Clinical Pharmacy-I
Community Pharmacy
Computer and its Application in Pharmacy
Forensic Pharmacy
Hospital Pharmacy
Instrumentation
Pathology
Pharmaceutical Quality Management
Pharmaceutical Technology
Pharmacy Management and Marketing

**Practical**
Biopharmaceutics
Clinical Pharmacy
Clinical Pharmacy-II
Clinical Pharmacy-III
Community Pharmacy
Computer and its Application in Pharmacy
Instrumentation
Pathology
Pharmaceutical Quality Management
Pharmaceutical Technology
# COURSES FOR M.PHIL

## SCHEME OF STUDIES

FOR

M.PHIL. PHARMACEUTICS

(Annual System)

## PART-I

### THEORY

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### PRACTICALS

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| Total:               | 500   |

## PART-II

### THESIS

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Grand Total: 700

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COURSE CONTENTS
M.PHIL. PART-I PHARMACEUTICS

PAPER-I PHARMACEUTICS-I (Written) 100 Marks

A. Advanced Pharmaceutics
   1. Surfactants and their applications in Pharmaceutical Dosage Forms.
   2. Specialized Pharmaceutical Emulsions.
   4. Micro encapsulation/Methods of Particles coating.
   5. Cosmetics and their quality control.
   6. Transdermal drug delivery system.

B. Biopharmaceutics
   1. Correlation between in-vitro and in-vivo studies of different parameters of dosage forms.
   2. Biopharmaceutical and Pharmacokinetic consideration in the development of controlled release drug products.
   3. Pharmacokinetic and Bioavailability Variations in disease state.
   5. Bioavailability of disperse dosage forms.

C. Pharmaceutical Microbiology
   1. Microbial Enzymes: Classification and Mechanism of Action, Commercial Production of microbial enzymes and their application, Immobilized Enzymes.
   2. General Principles and Methods of Microbiological assays.
   3. Microbial spoilage and preservation of pharmaceutical products.
   5. Principles, synthesis and applications of Monoclonal antibodies.

PAPER-IV PHARMACEUTICS-I (Practical-I) 100 Marks

At least 20 practical will be conducted according to the theory and available facilities, e.g. Particle size analysis, Stability studies of Pharmaceuticals, Coating of Particles, Preparation and quality Control of cosmetics, to prepare, examine and control specifications for the packaging materials, Determination of rheological properties of pharmaceutical preparation, Crude drug assays: Humidity and Moisture determination, Evaluation of disintegration in-vitro and in-vivo and its comparison with dissolution rate in-vitro and in-vivo, Determination of plasma protein binding, Correlation between in-vitro and in-vivo studies of different parameters of dosage forms, Determination of drug
metabolites in-vitro and in-vivo samples, Development of transdermal preparation, Staining of cell wall along with other important staining techniques, Response of heat, dyes and other chemical disinfectants against bacteria, Observation of drug resistant bacteria and isolation of certain mutants by Replication technique, Preparation of media and isolation of pure cultures and performance of culture sensitivity tests, Determination of phenol coefficient, Antibiotic sensitivity tests and Microbiological assays, Assay of Microbial Enzymes, Microbial studies of sputum, Urine and blood samples.

**Recommended Books**


**PAPER-II PHARMACEUTICS-II (Written) 100 Marks**

**A. Formulation and Product Development**
2. Radiopharmaceutical formulation techniques, Q.C. instrumentation and application in health care system.
5. Quality Control and GMP Compliance in Pharmaceutical Industry. Importance of design/layout of pharmaceutical industry.
7. Safety tests in Pharmaceutical Preparations.
8. Stability testing.
9. Validation of sterilization procedure.
10. Calibration and Validation of instruments/equipments used in testing and manufacturing of drugs.
11. Time and Motion Study.

**B. Clinical Pharmacy**
1. Latest developments and advances in the learning of clinical Pharmacy.
2. Patient Communication.
3. Surgical Supplies.
4. Total Parenteral Nutrition.
5. Problem Oriented Approach: Cardiovascular Disorders, Infectious diseases, Renal diseases, Respiratory Diseases.
6. Specific Poisons and drugs: Diagnosis and treatment, Anti-biotics, Antidepressants, Arsenic, Benzodiazepines, Analgesics, Calcium antagonists, Digoxin, Nitroglycerin and Cyanide.
7. Pharmacy Administration.

**PAPER-V: PHARMACEUTICS-II (Practical-II) 100 Marks**

At least 20 practical will be performed relevant to the theory and available facilities e.g. Design and Development of Controlled Release Tablets, Design and development of controlled release formulations, Formulation of Aerosols, Ophthalmic and Parenteral Preparations, Stability studies of Finished Pharmaceutical Products, Quality control of pharmaceutical dosage forms and raw materials, Patient Drug Profile, Ward Round Report, Pharmaceutical Marketing Survey.

**Recommended Books**

Paper-III  BIOSTATISTICS (Theory)  100 marks.

1. **Introduction**: What is Biostatistics? Application of statistics in biological and pharmaceutical sciences.
2. **Sample and Population**: Simple random sampling, Sampling distribution and standard error, Stratified random sampling, Systemic and cluster sampling.
3. **Test of Hypothesis and significance**: Statistical hypothesis, Level of significance, Test of significance, Confidence intervals, Test involving binomial and normal distribution.
4. **Goodness of fit test**: Chi-square distribution, it properties and application, Contingency tables, Test of homogeneity.
5. **Student "t" and "F" Distribution**: Properties of "t" distribution and "F" distribution, Test of significance based on "t"-distribution and "F"-distribution.
6. **Analysis of variance**: One-way classification, Partitioning of sum of squares and degree of freedom, Two-way classification, Multiple compression tests such as LSD, P-values, The analysis of variance models.

**Recommended Books**


**NOTE:** An Industrial study tour will be an integral part of the courses of study in Pharmaceutics.
M.Phil. PART-II PHARMACEUTICS

THESIS  200 Marks

The research work will be carried out in any branch of Pharmaceutics. The thesis shall embody the results of research, which may either be continuation to the existing knowledge of the subject, or application of known methods of research to some technical problems. This will also include seminar and viva-voce examination concerning research topics. Three copies of research thesis printed or type written shall be submitted for the examination at the end of the academic year. The candidate will retain the fourth copy of the thesis.
SCHEME OF STUDIES
FOR
M.PHIL. PHARMACOGNOSY
(Annual System)

PART-I

THEORY

Title of Paper                      Marks
PAPER I: Pharmacognosy-I            100
PAPER II: Pharmacognosy-II         100
PAPER III: Biostatistics           100

PRACTICALS

PAPER IV: Pharmacognosy-I          100
PAPER V: Pharmacognosy-II         100

Total: 500

PART-II

THESIS                            200

Grand Total: 700
COURSE CONTENTS
M.PHIL. PART-I  PHARMACOGNOSY

PAPER-I  PHARMACOGNOSY-I (Written)  100 Marks

A. **Advances in Pharmacognosy:**
Pharmacological approaches to natural products, screening and evaluation, recent experimental and clinical data concerning anti-tumor and cytotoxic agents, problems and prospects of discovering new drugs from higher plants, Sapponins with biological and pharmacological activity. Tri-terpenoid, Saponins, Steroid Saponins, Alkaloids and Di-terpene from Euphorabiaceae, Mono-, Di- and Sesquiterpenes with pharmacological and therapeutic activity, Lignans and Neo-lignans with potential biological activity.

B. **Structure Elucidation of Natural Products:**
Application of spectroscopic and chemical techniques to the elucidation of the structure of natural products with particular reference to alkaloids, steroids, saponins, falvenoids and terpenes.

C. **Biosynthesis of Natural Products:**
Introduction, mechanism and biosynthetic formations of amino acids, carotenoids and vitamin A, water soluble vitamins, phenolic plant products, terpenes, steroids, alkaloids and glycosides.

D. **Plant Toxicology:**
An overview of plant toxicants, study of treatment and prevention of plants toxicities, simple phytotoxins, toxicity of pyrozolidine and indozolidine alkaloids, plant teratogens, plant irritant, plant induced cardiac and pulmonary diseases.

PAPER-IV  PHARMACOGNOSY-I (Practical-I)  100 Marks

At least 20 practical will be conducted according to the theory and available sources

**Recommended Books**
A. **Phytochemicals of Natural Origin**
Preparation of Corticosteroids from natural products like Steroidal Saponins, Sapogenins (Diosgenin etc.). Artemisinin derivative from antemisinin. Etoposide from Podophyllotoxin, Taxol derivatives, Morphine derivatives, Lysergic acid derivatives (Ergotamine, Methyl-lergonovine, Hydergine etc.) and other related topics of current interest.

B. **Quality Control of Herbal Drugs**
Effects of enzyme action in crude drugs.
Adulteration of crude drugs: Effect of faulty collection, Improper preparation for market, Improper storage conditions, Deliberate adulteration.

C. **Cell Biotechnology**: 
Development in plant cell cultures and recent approaches for high production of secondary metabolites (Drugs). Elucidation and regulation of biosynthesis in cell cultures of plant species of strategic importance from both scientific and economic point of view. Biotransformation of terpenes, alkaloids and steroids. Plant tissue cultures for the production of natural drugs.

D. **Spectroscopic Techniques**: 
Advanced treatment of major spectroscopic techniques for the characterization of organic and drug molecules by Ultraviolet and IR spectroscopy, Optical rotatory dispersion, Nuclear magnetic resonance spectroscopy, Circular dichroism and Mass spectrometry.

**PAPER-V PHARMACOGNOSY-II (Practical-II) 100 Marks**
At least 20 practicals will be conducted according to the theory and available sources.

**Recommended Books**

**PAPER-III  BIOSTATISTICS (Theory)  100 marks.**

1. **Introduction**: What is Biostatistics? Application of statistics in biological and pharmaceutical sciences.
2. **Sample and Population**: Simple random sampling, Sampling distribution and standard error, Stratified random sampling, Systemic and cluster sampling.
3. **Test of Hypothesis and significance**: Statistical hypothesis, Level of significance, Test of significance, Confidence intervals, Test involving binomial and normal distribution.
4. **Goodness of fit test**: Chi-square distribution, it properties and application, Contingency tables, Test of homogeneity.
5. **Student "t" and "F" Distribution**: Properties of "t" distribution and "F" distribution, Test of significance based on "t"-distribution and "F"-distribution.
6. **Analysis of variance**: One-way classification, Partitioning of sum of squares and degree of freedom, Two-way classification, Multiple compression tests such as LSD, P-values, The analysis of variance models.
7. **Experimental Designs: (Advantages & Disadvantages)** Basic principles of experimental designs, The completely randomized designs (CR-designs), Randomized complete block designs (RCB-designs), Latin square designs (LS-designs), Factorial experimental designs, Computer methods of statistical evaluation, Correlation/regression analysis.

**Recommended Books**

**NOTE**: A plant collection and study tour will be an integral part of the courses of study in Pharmacognosy.

**M.Phil. PART-II PHARMACOGNOSY**

| THESIS | 200 Marks |

The research work will be carried out in any branch of Pharmacognosy. The thesis shall embody the results of research, which may either be continuation to the existing knowledge of the subject, or application of known methods of research to some technical problems. This will also include seminar and viva-voce examination concerning research topics. Three copies of research thesis printed or type written shall be submitted for the examination at the end of the academic year. The candidate will retain the fourth copy of the thesis.
SCHEME OF STUDIES
FOR
M.PHIL PHARMACOLOGY
(Annual System)

PART-I

THEORY

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Total: 500

PART-II

THESIS 200

Grand Total: 700
COURSE CONTENTS
M.PHIL. PART-I PHARMACOLOGY

PAPER-I MAJOR PHARMACOLOGY-I (Theory) 100 marks.

1. **General Pharmacology**
   Pharmacokinetics, Pharmacodynamics, Pharmacological Screening and Standardization, Pharmacogenetics, Toxicity Testing, Adverse Drug Reaction, Drug Interactions, Hypersensitivity (Drug Allergy), Mutagenecity, Teratogenecity, Carcinogenicity.

2. **Cardiovascular System**
   Autonomic Nervous System, Drugs acting on cardiovascular system, Hypolipidemics, Anticoagulants, Procoagulants, Antiplatelets and Thrombolytics.

3. **Biochemical Pharmacology**
   Transcription and Translation of Genes, Neurohumoral Transmission and Signal Transduction, Eicosanoids (Histamine, Serotonin, Bradykinins & Other mediators of inflammation), Antihistamines, Anti-gout, Corticosteroids and Immunomodulators.

4. **Biochemical Techniques**

PAPER-IV MAJOR PHARMACOLOGY-I (Practical) 100 marks.

At least 20 practicals will be performed relevant to the theory and available facilities.

PAPER-II MAJOR PHARMACOLOGY-II (Theory) 100 marks.

1. **Chemotherapy**
   Antibacterials, Antifungals, Antivirals, Antiprotozoals, Anthelmintics and Anticancers
2. **Neuropsychopharmacology**

3. **Microbiology**
Bacterial and Fungal cell culture isolation, Identification and maintenance of pure culture, Immunology, Vaccines, Sera, Toxins and Anti-toxins, Protozoal Diseases, Bacterial, fungal and Viral Origin.

**PAPER-V MAJOR PHARMACOLOGY-II (Practical) 100 marks**

At least 20 practicals will be performed relevant to the theory and available facilities.

**PAPER-III BIOSTATISTICS (Theory) 100 marks**

1. **Introduction**: What is Biostatistics? Application of statistics in biological and pharmaceutical sciences.
2. **Sample and Population**: Simple random sampling, Sampling distribution and standard error, Stratified random sampling, Systemic and cluster sampling.
3. **Test of Hypothesis and significance**: Statistical hypothesis, Level of significance, Test of significance, Confidence intervals, Test involving binomial and normal distribution.
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6. **Analysis of variance**: One-way classification, Partitioning of sum of squares and degree of freedom, Two-way classification, Multiple compression tests such as LSD, P-values, The analysis of variance models.
7. **Experimental Designs: (Advantages & Disadvantages)** Basic principles of experimental designs, The completely randomized designs (CR-designs), Randomized complete block designs (RCB-designs), Latin square designs (LS-designs), Factorial experimental designs, Computer methods of statistical evaluation, Correlation/regression analysis.

**Recommended Books**
(Pharmacology)

(Biostatistics)

NOTE: An Industrial study tour will be an integral part of the courses of study in Pharmacology.
M. Phil. PART-II PHARMACOLOGY

THESIS 200 Marks

The research work will be carried out in any branch of Pharmacology. The thesis shall embody the results of research, which may either be continuation to the existing knowledge of the subject, or application of known methods of research to some technical problems. This will also include seminar and viva-voce examination concerning research. Three copies of research thesis printed or type written shall be submitted for the examination at the end of the academic year. The candidate will retain the fourth copy of the thesis.
SCHEME OF STUDIES
FOR
M.PHIL. PHARMACEUTICAL CHEMISTRY
(Annual System)

PART-I

THEORY

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PART-II

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Grand Total: 700
COURSE CONTENTS

M.PHIL. PART-I PHARMACEUTICAL CHEMISTRY

PAPER I PHARMACEUTICAL CHEMISTRY-I (Written) 100 Marks

A. Electroanalytical Techniques
Introduction to Electrochemical methods
Classification of electrochemical methods, advantages and limitations of electrochemical methods, electrochemical terminology, Principles of electrochemical cell, Nernest equation, potential generation across membrane, ion-selective electrodes, dropping mercury electrode, rotating platinum, gold and carbon electrodes.

Controlled-Potential Techniques
Chronoamperometry, Chronocoulometry, D.C. polarography, Cyclic voltametry, Rotating disc voltametry, Amperometric titrations.

Controlled-Current Techniques
Chronopotentiometry, Cyclic chronopotentiometry, Electrochemical sensors, photoelectrochemistry, Electrochemical analysis of substances of pharmaceutical and biological interest, Electrochemical study of the mechanism of organic reactions.

B. Spectrophotometric Analysis
Instrumentation:
Radiation sources, monochromators, detectors, signal processors, read-out devices, single and double-beam spectrophotometers.

Ultraviolet and Visible Spectrophotometry

Difference, derivative and dual-wavelength Spectrophotometry
Application in determination of molecular weight, rate constants and ionization constants; spectrophotometric titrations.

Infrared spectrophotometry
Near infrared spectroscopy, Fourier transform infrared spectroscopy, quantitative analysis.

Fluorescence Spectrophotometry
Factors affecting fluorescence, quantitative analysis of single and two component system, derivatization reactions, advantages of flourimetric methods.

Transient Absorption Spectroscopy
Flash spectroscopy, transient absorption spectra and life-time measurements of singlet, triplet and radical species.

Analytical Development in Spectrophotometry
Physical and chemical properties of medicinal and Pharmaceutical substances relevant to analytical development: colorimetric, enzymatic and photochemical reactions in spectrophotometric analysis, analytical problems in Multicomponent systems and formulated products, development of stability indicating assays.

C. Drug Designing And Synthesis

Quantitative model construction

D. Drug Stability And Drug Group Analysis
Drug decomposition, stabilization and preservation, Kinetics of complex reactions, accelerated storages tests, expiry dates.

Effect of physical and chemical factors on drug stability
Thermal and photo stability of pharmaceutical substances in solid and liquid dosage forms; photo chemical interaction, photo catalysis and photo sensitization of drugs. Oxidative, hydrolytic addition, racemisation and epimerization reactions using drug as typical examples. Application of various analytical methods to the assay of antibiotics, benzodiazepines, phenol-thiazines, steroids and sulphonamides,

PAPER IV PHARMACEUTICAL CHEMISTRY-I (Practical) 100 Marks
At least 20 practicals will be conducted according to the theory and available facilities.

Recommended Books

PAPER II  PHARMACEUTICAL CHEMISTRY-II (Written)  100 Marks

A. **Combinatorial Chemistry**
1. Introduction to reactive and functional polymers.
3. Polymer – supported reactions versus solution-phase reactions.
4. Automated synthesis the breakthrough point.
7. Combinatorial chemistry – methods.
10. Design of new catalysts by combinatorial chemistry.
11. Possible limitations of combinatorial chemistry.
12. Redesigning combinatorial technology – from here to the unknown.

B. **Polymers In Controlled Drug Delivery**
1. Introduction to synthetic polymers.
2. Conventional Vs. controlled release: Advantages and disadvantages, Pharmacokinetic consideration, Polymer as drug carrier.
3. Monolithic matrix controlled systems: Dissolved drugs, Dispersed drugs, Drug dissolution/diffusion controlled system.
4. Member controlled system: Constant activity reservoir, Unsteady state analysis (time-lag and burst effect), Drug release from multilayer membrane devices, Drug release from membrane matrix system.
5. Swelling controlled systems: Hydro gels, Polymer degradation and erosion, Erosion/drug diffusion controlled, Swelling/erosion controlled.

C. **Isolation Techniques For Drug Analysis**
**General Principles**: Extraction Methodology.
**Isolation and Separation Techniques**:
*Chromatography*: Definition and basic principles of chromatographic procedure.
*Adsorption Column Chromatography*: Theory, stationary and mobile phase chromatography, application to the analysis of drugs and metabolites.
*Paper Chromatography*: Ascending and descending techniques, solvent systems, visualization.
*Open-Bed Chromatography*.
Thin-layer chromatography: Theory, types of stationary phases and solvents, visualization and identification qualitative and quantitative applications to the analysis of drugs and metabolite.

Adsorption Column Chromatography: Theory, stationary and mobile phase chromatography, application to the analysis of drugs and metabolites.

High Performance Liquid Chromatography: Theory, stationary and mobile phase, recent advances, applications to the analysis of drugs and metabolites.

Gas Chromatography: Theory, retention properties of stationary phases, derivatization techniques (methylation, acylation, silylation, etc) capillary GC, GC-Mass spectrometry application to the analysis of drugs and metabolites

Size Exclusion Chromatography: Theory, types of stationary phase, separation of high molecular weight organic compounds and biopolymers.

D. Macromolecular Targets For Drug Action

PAPER V PHARMACEUTICAL CHEMISTRY-I (Practical) 100 Marks

At least 20 practicals will be conducted according to the theory and available facilities.

Recommended Books
11. Arno F Spatola, Combinatorial Chemistry and Molecular Diversity Course at the University of Louisville: A Description. Department of Chemistry, University of Louisville. 1996.

### Paper-III  BIOSTATISTICS (Theory)  100 marks.

1. **Introduction**: What is Biostatistics? Application of statistics in biological and pharmaceutical sciences.
2. **Sample and Population**: Simple random sampling, Sampling distribution and standard error, Stratified random sampling, Systemic and cluster sampling.
3. **Test of Hypothesis and significance**: Statistical hypothesis, Level of significance, Test of significance, Confidence intervals, Test involving binomial and normal distribution.
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6. **Analysis of variance**: One-way classification, Partitioning of sum of squares and degree of freedom, Two-way classification, Multiple compression tests such as LSD, P-values, The analysis of variance models.
7. **Experimental Designs: (Advantages & Disadvantages)** Basic principles of experimental designs, The completely randomized designs (CR-designs), Randomized complete block designs (RCB-designs), Latin square designs (LS-designs), Factorial experimental designs, Computer methods of statistical evaluation, Correlation/regression analysis.

**Recommended Books**

**NOTE:**  An Industrial study tour will be an integral part of the courses of study in Pharmaceutical Chemistry.

**M.Phil. PART-II PHARMACEUTICAL CHEMISTRY**

**THESIS**  200 Marks

The research work will be carried out in any branch of Pharmaceutical Chemistry. The thesis shall embody the results of research, which may either be continuation to the existing knowledge of the subject, or application of known methods of research to some technical problems. This will also include seminar and viva-voce examination concerning research topics. Three copies of research thesis printed or type written shall be submitted for the examination at the end of the academic year. The candidate will retain the fourth copy of the thesis.
RECOMMENDATIONS

1. The B-Pharmacy 4 years degree must be upgraded to Pharm-D with a duration of 5 years.

2. Pharm-D will be the first degree in Pharmacy.

3. The Pharm-D 5 years curriculum approved by the National Curriculum Revision Committee of HEC and Pakistan Pharmacy Council will be considered as minimum standards.

4. All the persons holding B-Pharmacy (4 years) degree should be given the opportunity to upgrade to Pharm-D (5 years) if they so desire.

5. From 2005 there will be no admission in the B-Pharmacy (4 years) degree programme.

6. The revision/upgradation of curriculum in pharmacy should be through the Higher Education Commission and its subsequent approval by the Pharmacy Council of Pakistan.

7. The HEC is requested to build liaison with Federal and Provincial Governments for affiliation of hospitals with Pharmacy Institutions for imparting training of students in Pharm-D degree program which is a requirement of clerk-ship training in clinical and hospital pharmacy as a part of their curriculum.