



FACULTY OF
**Pharmacy and
Pharmaceutical
Sciences**



FACULTY OF
**Pharmacy and
Pharmaceutical
Sciences**

University of Karachi

CATALOGUE
2023 – 2024

FACULTY OF PHARMACY
&
PHARMACEUTICAL SCIENCES



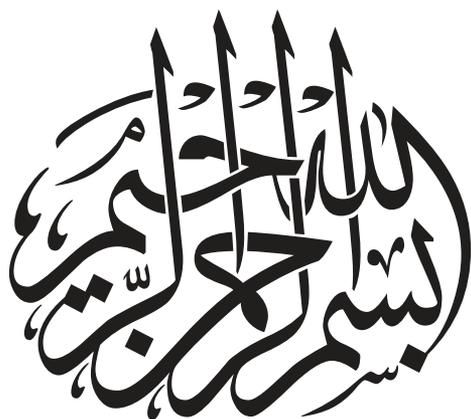
CATALOGUE

2023 – 2024

**FACULTY OF PHARMACY AND
PHARMACEUTICAL SCIENCES**
University of Karachi, Karachi-75270

The catalogue 2023-2024 provides criteria for selection of students, detailed syllabi of prescribed courses, schedule of teaching, protocol for examinations, grading system, and conditions for the award of degree. Introduction of the departments, introduction of the faculty members, facilities available, details of co-curricular activities etc.

Students are advised to read it carefully and act accordingly so as to get acquainted with all the necessary information with respect to their faculty and profession.



**In the Name of Allah,
the Most Beneficent,
the Most Merciful**

رَبِّ
زِدْنِي عِلْمًا

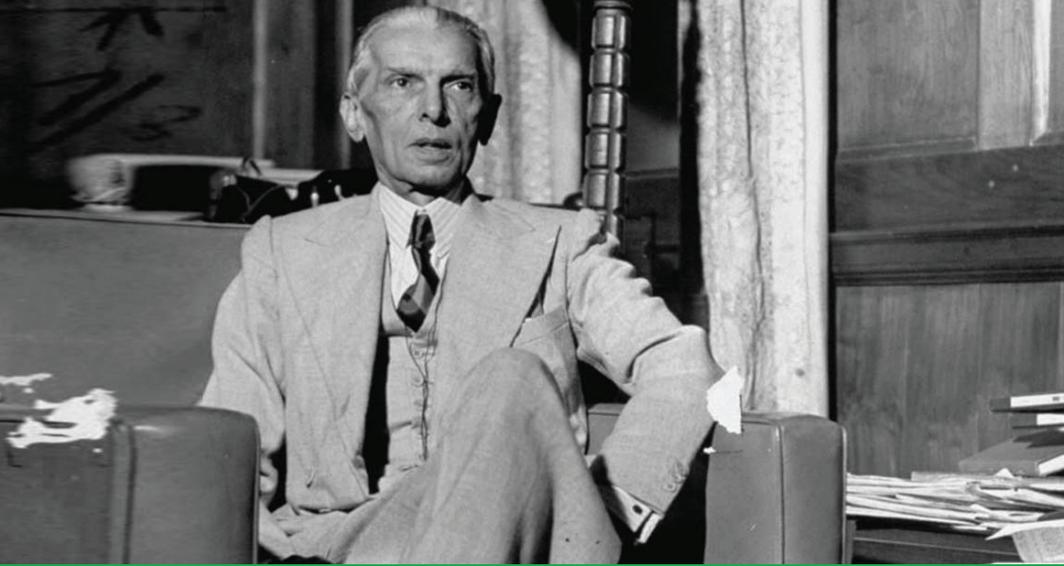
**O My Lord! increase
me in knowledge**

Quran (20:114)

وَإِنِّي مَرْضِيٌّ
فَهُوَ شَافِيٌّ

**And when I am sick,
He who heals**

Quran (26:80)



Advice of the Quaid to Students

“My young friends, I look forward to you as the real makers of Pakistan. Do not be exploited and do not be misled. Create amongst yourself complete unity, solidarity and discipline. I assure you: “Divided you fall, United you stand”. Set an example of what youth can do. If you fritter away your energies now, you will always regret. You must now realize that fresh fields, new channels and avenues are now being thrown open to you, where you have unlimited opportunities, namely, you must now direct your attention to science, commercial banking, insurance, industry and technical education. After you leave the portals of your universities and colleges then you can play your part freely and help yourself and the state”.

March, 1948

Contents

Messages	
Vice Chancellor	8
Dean, Faculty of Pharmacy and Pharmaceutical Sciences	9
Board of Faculty	11
Introduction - University of Karachi	15
Introduction - Faculty of Pharmacy and Pharmaceutical Sciences	16
Pharm. D. Program	18
Student Facilities	18
Publications	20
Admission and Examinations Under-graduate Studies	21
Course Schedule - Pharm. D. Program	26
Course Schedule - Pharm. D. (deficiency) Program	31
Department of Pharmaceutics	34
Laboratory and Classroom Facilities	35
Career Opportunities	35
Faculty Profiles	36
Board of Studies	40
Pharm. D. Courses	41
Pharm. D. Courses - Outline	42
Pharm. D. (deficiency) Courses	58
Pharm. D. (deficiency) Courses - Outline	59
Department of Pharmaceutical Chemistry	64
Faculty Profiles	66
Board of Studies	70
Pharm. D. Courses	71
Pharm. D. Courses - Outline	72
Pharm. D. (deficiency) Courses	84
Pharm. D. (deficiency) Courses - Outline	84
Department of Pharmacology	88
Faculty Profiles	90
Board of Studies	93
Pharm. D. Courses	94
Pharm. D. Courses - Outline	95
Pharm. D. (deficiency) Courses	110
Pharm. D. (deficiency) Courses - Outline	111
Department of Pharmacognosy	116
Faculty Profiles	118
Board of Studies	120
Pharm. D. Courses	121
Pharm. D. Courses - Outline	121
Pharm. D. (deficiency) Courses	134
Pharm. D. (deficiency) Courses - Outline	134
Department of Pharmacy Practice	136
Faculty Profiles	138
Board of Studies	139
Pharm. D. Courses	140
Pharm. D. Courses - Outline	141
Important Rules to Remember	145
Guidelines to Participate in Convocation	146
Academic Calendar	147

Message



Prof. Dr. Khalid Mehmood Iraqi

Vice Chancellor, University of Karachi

It is heartening to see that the faculty of Pharmacy and Pharmaceutical Sciences continues its tradition of publishing the 2025-26 catalog to guide the newly admitted students. This initiative reflects the faculty's dedication to fostering a welcoming environment and strengthening the bond between teachers and students.

The catalogue serves as a comprehensive guide, offering valuable insights into faculty members, the syllabus, departmental details, and both curricular and co-curricular activities. I am confident that this resource will greatly assist students in navigating their academic journey and encourage them to uphold the faculty's rules and regulations.

I commend the faculty for their tireless efforts and unwavering commitment to supporting students and contributing to their academic and personal growth.

A handwritten signature in black ink, consisting of a stylized 'Q' followed by a horizontal line and a small flourish.

Prof. Dr. Khalid Mehmood Iraqi

Message



Prof. Dr. Faiyaz HM Vaid

Dean (2023),

Faculty of Pharmacy & Pharmaceutical Sciences

My Dear Students,

I congratulate you on becoming a part of our Pharmacist Fraternity and welcome you to this Faculty of Pharmacy and Pharmaceutical Sciences which is rated as one of the best in Pakistan. It is an honor and a privilege to study in this most prestigious and globally reputed institution. Now it is for you to nurture your abilities and exploit all the potential you possess for becoming a well-groomed professional and a better citizen.

The Catalogue in your hands is a source of all the necessary and relevant information that you may require to embark on an educative journey at the Faculty of Pharmacy. It includes all the details of the rules and regulation, course outlines, facilities available, student activities and most importantly the introduction of the Faculty. I am sure that you will abide by all the rules and would display utmost discipline and the best of your talents in studies as well as co-curricular activities.

I wish you all the best.

A handwritten signature in black ink, appearing to be 'F. H. Vaid', written in a cursive style.

Prof. Dr. Faiyaz HM Vaid

Message



Prof. Dr. M. Harris Shoab

Dean (2024),

Faculty of Pharmacy & Pharmaceutical Sciences

With great pleasure, I welcome you to the Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi, for the academic year 2023-2024. You are about to embark on an exciting journey in the Doctor of Pharmacy (Pharm.D.) program, a field dedicated to improving health and transforming lives through the art and science of medication.

At the University of Karachi, we pride ourselves on our rich history of academic excellence, cutting-edge research, and commitment to producing professionals who excel in pharmaceutical sciences. Our program is designed to equip you with a strong foundation in pharmaceutical knowledge, practical skills, and ethical principles, ensuring that you become competent and compassionate pharmacists.

You will be able to learn from distinguished faculty members, engage in collaborative research, and gain hands-on experience through internships and practical training. Beyond academics, I encourage you to participate in extracurricular activities, explore new interests, and make lifelong connections within our vibrant and diverse campus community.

As you begin this transformative journey, remember that the path to success is built on dedication, resilience, and a thirst for knowledge. Our faculty and staff are here to support you every step of the way, ensuring that you achieve your academic and professional aspirations.

Once again, welcome to the Faculty of Pharmacy and Pharmaceutical Sciences. I wish you a successful and fulfilling academic journey at the University of Karachi.

A stylized, handwritten signature in black ink, appearing to read 'M. Harris Shoab', written over a white background.

Prof. Dr. M. Harris Shoab

Board of Faculty

2023

Dr. Faiyaz H M Vaid

Professor
Dean, Faculty of Pharmacy and
Pharmaceutical Sciences
University of Karachi.

Dr. Zaheer Qasmi

Professor
(Nominee of Academic Council)
HEJ Research Institute of Chemistry
University of Karachi.

Dr. Tanveer Abbas

Professor
(Nominee of Academic Council)
Department of Microbiology
University of Karachi.

Dr. Saifullah

Professor
(Nominee of Academic Council)
Department of Biotechnology
University of Karachi.

Dr. Iqbal Azhar

Professor
Chairman, Department of Pharmacognosy
University of Karachi.

Dr. Muhammad Harris Shoaib

Professor
Department of Pharmaceutics
University of Karachi.

Dr. Nousheen Mushtaq

Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Mansoor Ahmed

Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Afaq Ahmed Siddiqui

Professor
Department of Pharmaceutical Chemistry
University of Karachi

Dr. Syeda Afroz

Associate Professor
Department of Pharmacology
University of Karachi.

Dr. Muhammad Mohtasheem-ul-Hassan

Associate Professor
Department of Pharmacognosy
University of Karachi.

Dr. Farid Hassan

Associate Professor
Department of Pharmaceutics
University of Karachi.

Continued on next page



Board of Faculty

2023

Dr. Iyad Naeem Mohammad

Associate Professor
Coordinator, Department of Pharmacy Practice
University of Karachi.

Dr. Sohail Hassan

Associate Professor
Chairman, Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Rabia Ismail Yousuf

Associate Professor
Chairperson, Department of Pharmaceutics
University of Karachi.

Dr. Afshan Siddiq

Associate Professor
Chairperson, Department of Pharmacology
University of Karachi.

Dr. Asia Naz

Associate Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Azra Riaz

Assistant Professor
Department of Pharmacology
University of Karachi.

Dr. Rehana Saeed

Assistant Professor
Department of Pharmaceutics
University of Karachi.

Dr. Shazia Haider

Assistant Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Maryam Ahmed

Assistant Professor
Department of Pharmacognosy
University of Karachi.

Dr. Tazeen Hussain

Lecturer
Department of Pharmaceutics
University of Karachi.

Dr. Adnan Iqbal

Lecturer
Department of Pharmacology
University of Karachi.

Board of Faculty

2024

Dr. Muhammad Harris Shoaib

Professor
Dean, Faculty of Pharmacy and
Pharmaceutical Sciences
University of Karachi.

Dr. Zaheer Qasmi

Professor
(Nominee of Academic Council)
HEJ Research Institute of Chemistry
University of Karachi.

Dr. Saifullah

Professor
(Nominee of Academic Council)
Department of Biotechnology
University of Karachi.

Dr. Iqbal Azhar

Professor
Chairman, Department of Pharmacognosy
University of Karachi.

Dr. Faiyaz H M Vaid

Professor
Chairman, Department of Pharmaceutical
Chemistry
University of Karachi.

Dr. Nousheen Mushtaq

Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Muhammad Mohtasheem-ul-Hassan

Associate Professor
Department of Pharmacognosy
University of Karachi.

Dr. Farid Hassan

Associate Professor
Chairman, Department of Pharmaceutics
University of Karachi.

Dr. Afshan Siddiq

Associate Professor
Chairperson, Department of
Pharmacology
University of Karachi.

Dr. Sohail Hassan

Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Asia Naz

Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Dr. Safeela Naveed

Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Continued on next page



Board of Faculty

2024

Dr. Syeda Afroz

Associate Professor
Department of Pharmacology
University of Karachi.

Dr. Maryam Ahmed

Assistant Professor
Department of Pharmacognosy
University of Karachi.

Dr. Iyad Naeem Mohammad

Associate Professor
Coordinator, Department of Pharmacy
Practice
University of Karachi.

Dr. Tazeen Hussain

Lecturer
Department of Pharmaceutics
University of Karachi.

Dr. Rabia Ismail Yousuf

Associate Professor
Department of Pharmaceutics
University of Karachi.

Dr. Adnan Iqbal

Lecturer
Department of Pharmacology
University of Karachi.

Dr. Azra Riaz

Assistant Professor
Department of Pharmacology
University of Karachi.

Dr. Rehana Saeed

Assistant Professor
Department of Pharmaceutics
University of Karachi.

Dr. Shazia Haider

Assistant Professor
Department of Pharmaceutical Chemistry
University of Karachi.

Introduction

University of Karachi

The University of Karachi was established in 1951 under a charter of the Central Government. Until 1959, it was housed in a rented building situated in a congested area of the city. In 1960, it was relocated to the present campus, sprawling over an area of nearly two square miles. The campus has since been growing steadily. In its present state, it affords many facilities to the students and strives hard with a vision to become a modern, well-equipped University town for the students that their successors will be proud of.

Altogether over 25,000 regular students are enrolled in 58 departments functioning under 9 faculties: Arts, Science, Engineering, Administrative and Management Sciences, Education, Islamic Learning, Law, Pharmacy and Pharmaceutical Sciences, and Medicine as well as 20 research institutes and centers. More than 150 colleges are affiliated with the University, and therefore University of Karachi is an affiliating, examining and teaching body, and hence caters to the teaching requirement of over 25 million population of the city.

The University has the best teaching staff consisting of more than 800 teachers. Most of the teachers are highly qualified, having Ph.D. and D.Sc. degrees from Pakistan and abroad, and out of them, some are of international fame. University, being located in the port city of Karachi, serves as the window of higher education in Pakistan. The University has acquired a high status in the field of education in Pakistan as well as abroad within a span of 70 years. Presently it occupies a prominent place especially in teaching and research in Science, Pharmacy, Administrative and Management Sciences and Medicine.

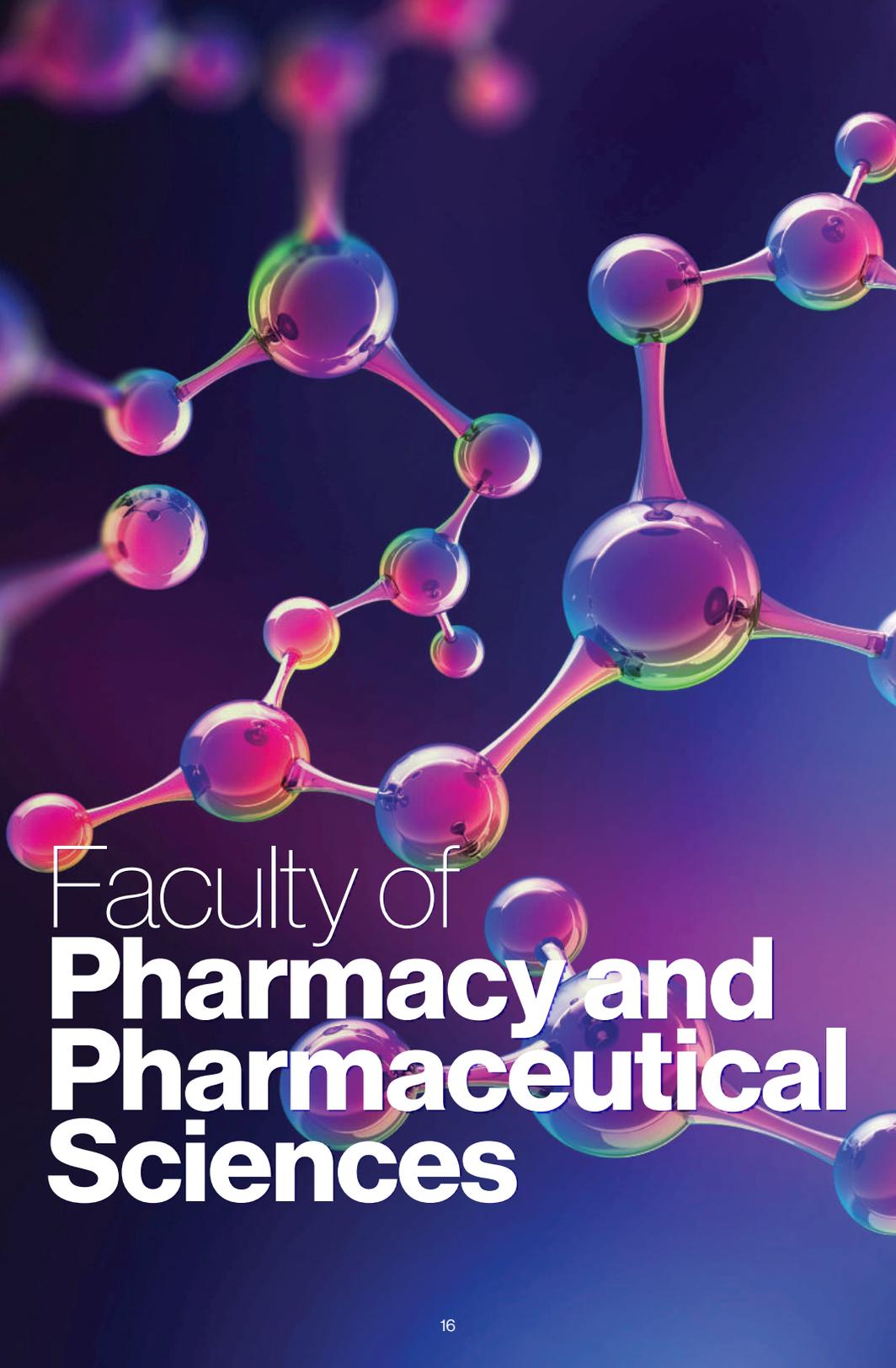
The University, on its part, provides good facilities to promote learning. The University library, for instance, is stocked with the latest books in various fields and is virtually a storehouse of information.

A university is a seat of learning; its primary aim is to promote the pursuit of knowledge. Examination and degrees play only a secondary role in its functions. The development of students' minds and character are the lasting acquisitions, the value of degrees and diplomas is only ephemeral.

There are facilities for sports of all kinds to enable the students to develop a spirit of healthy competition. The University gymnasium offers the students ample opportunities to develop their physique, because a healthy mind can reside only in a healthy body.

Beside subject arcades and clubs, there are forums for free and unfettered exchange of views among students. It also helps to foster a spirit of cooperation and offers good training in civic responsibilities. It is a platform for healthy discussion, and while participating in its activities one must see that one should not overstep the limits by indulging in irresponsible and destructive talks and activities. All co-curricular activities are intended to make students' lives richer by increasing their contacts with their fellow students and teachers.

The campus, however, represents only one aspect of the University; the other and more important aspect is the cooperation between the students and the teachers which alone can create a healthy academic atmosphere in the University conducive to learning. Education is a two-way process and it can be accomplished only if the teacher and the student both actively participate in it. Remember that the keenness of the teacher to give is always proportional to the keenness of the student to receive; meaning that the students must bring a good deal of earnestness and enthusiasm to bear upon their studies if they want to reap the maximum benefit from their stay in the University.



Faculty of
**Pharmacy and
Pharmaceutical
Sciences**

The Faculty of Pharmacy and Pharmaceutical Sciences of the University of Karachi owes its origin from the Department of Pharmacy, which was established in 1964. The Department of Pharmacy in this university was founded in response to the need for a better drug delivery system in hospital and retail pharmacy, and also to cater the ever growing need of the pharmaceutical industry, as 90 percent of the drug based industry in Pakistan, both national and multinational, are located at Karachi. The development of pharmacy education at the University of Karachi was very rapid, and in a very short span of time it occupied a prominent position as the largest pharmacy teaching institution, and has made a significant contribution in the development of the pharmaceutical industry. The erstwhile Department of Pharmacy was raised in 1973 into a full-fledged and the first Faculty of Pharmacy in the country which at that time was comprised of 4 teaching and research departments, such as: Pharmaceutics, Pharmaceutical Chemistry, Pharmacology and Pharmacognosy. In 2008 the 4 year B-Pharm degree was replaced by a 5 years Pharm-D degree program on the recommendation of Pharmacy Council of Pakistan and Higher Education Commission. As a consequence to this, a fifth department of Pharmacy Practice was launched in 2015. More than 2000 regular students are today pursuing their studies leading to the award of Doctor of Pharmacy (Pharm. D.), Master of Philosophy (M. Phil.), and Doctor of Philosophy (Ph.D.) degrees.

The Faculty of Pharmacy and Pharmaceutical Sciences has so far produced around 8500 B. Pharms. /Pharm. Ds., 220 Ph. Ds., 300 M. Phils., and 358 M. Pharms. This constitutes the largest figure of graduates and post graduates from any pharmacy institution of the country. Moreover around 1250 research papers have also been published in national and international journals by the faculty members.

The Faculty of Pharmacy and Pharmaceutical Sciences has well equipped laboratories in all the departments, which fully cater to the teaching and research needs of the various degree programs. Moreover, there is a good library with an e-library and internet facility. The faculty took another step forward to establish an Institute of Pharmaceutical Sciences under its auspices so as to give more impetus to scientific and technological research and development. This institution has been recently renovated and re-designed keeping in view the current demands of the field.

The Faculty of Pharmacy and Pharmaceutical Sciences of the University of Karachi, in keeping with its tradition and its accomplishments, will continue to carry out its mission as a leading institution to excel higher learning in pharmaceutical sciences in Pakistan.

Recently, new buildings of each department of the Faculty of Pharmacy and Pharmaceutical Sciences and a separate building for the office of the Dean are being constructed and have been made fully functional.

Pharm. D. Program

Pharmacy is a distinct profession and the success of any health program depends on it. With the rise of population worldwide during the last few decades, it has been realized that the traditional medical and health services now play a limited role in the overall improvement of health status. This fact has driven all health professionals to the common goal of disease prevention and health promotion. In developed countries, the clinical direction of pharmacy has de-emphasized the manipulative product oriented and distributive skills and focused more on the public health awareness. Today, the pharmacist's attention is directed towards the patient, his environment, and his state of general well-being. Pharmacy has achieved many successes in the past few years. It has undergone a transformation whereby both practice and teaching of the subject has been placed on more quantitative, rational and scientific bases, so much so that the drug-oriented pharmacy has now attired itself to patient-oriented pharmacy in most of the Western World.

In the United States, the Pharmacy professional is highly patient oriented; the pharmacist has many more opportunities in hospital and community environment. Same

trend is being followed 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 are preparing our graduates for the changing trends, especially if they aim to work globally. This has become possible by reviewing our Pharmacy syllabi and changing the same to meet the local and global needs and requirements.

The Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi after a long and thorough discussion as well as practical work, converted the curriculum proposed by Pharmacy Council of Pakistan, PCP (based on annual examination system) into semester examination system. The Pharm. D. program is based on 200 credit hours courses. The faculty has also designed one year deficiency courses of 2 semester duration for those holding 4 years B. Pharm. degree in order to upgrade to Pharm. D. (5 years program) if they so desire. These courses have been approved by the Board of Studies of each department and by the Board of Faculty, as well as academic council of the University.

Student Facilities

1. Foreign Students

Faculty of Pharmacy and Pharmaceutical Sciences admits 20 foreign students to Pharm. D. degree course every year. These admissions are not given directly but only after being duly processed by the concerned Embassies and the Ministry of Economic Affairs in Islamabad.

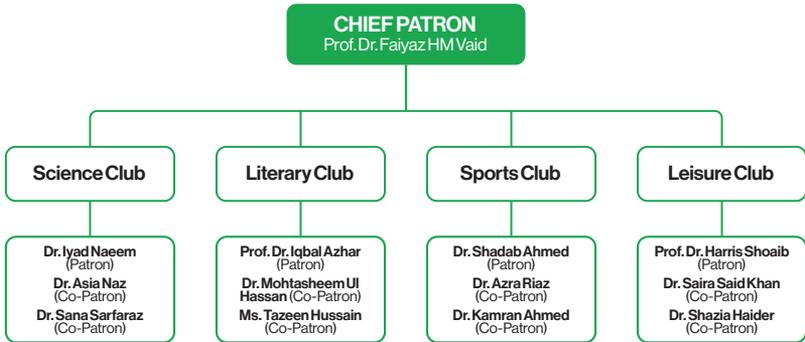
2. Co-Curricular Activities

a. Annual Tour

Students of Pharm. D. final year tour the country as a part of their training to get acquainted with the various pharmaceutical industries as well as various Pharmacy Institutions (Public Sector) of the country along with sight seen of our beautiful Pakistan, while the junior students visit the local industries.

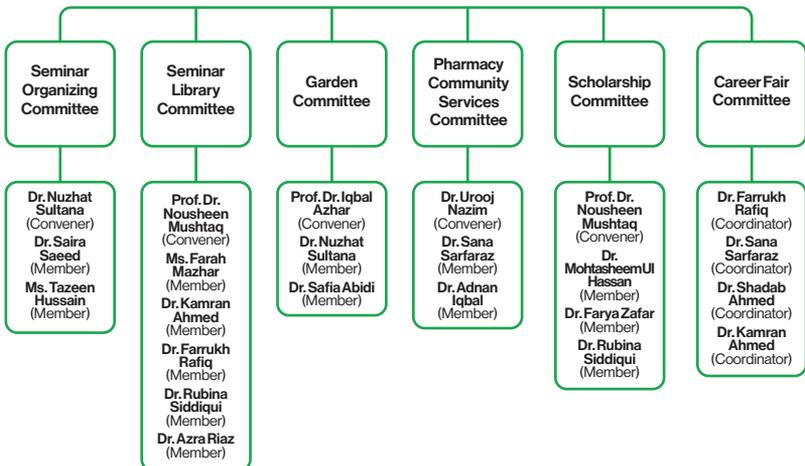
b. Pharmacy Students Clubs

Karachi University Pharmacy Students Club (KUPSC) came into being in 2013, exclusively for pharmacists. Each Club has a number of enrolled students for participating and organizing different events related to sports, literature, drama, science, and leisure activities. KUPSC is looking after these areas under the supervision of faculty members as their patrons.



c. Committees of Faculty of Pharmacy

In order to run the faculty smoothly and efficiently in a healthy environment and to enhance the overall quality of the faculty, different committees have been established. These committees are comprised of energetic faculty members who along with students fulfill the tasks assigned to them.



d. Faculty of Pharmacy Students Advisors

In order to deal with the day to day problems of the students and to maintain discipline in the faculty, highly skilled and energetic faculty members have been appointed as student advisors. They also facilitate and collaborate with the clubs and committees in organizing different programs.

List of Student Advisors

- Dr. Shadab Ahmed
- Dr. Rubina Siddiqui
- Dr. Asia Naz
- Dr. Safia Abidi
- Dr. Sana Sarfaraz
- Dr. Kamran Ahmed
- Dr. Urooj Nazim
- Dr. Farrukh Rafiq

3. Incentives and Assistance

a. President's Award

Ministry of Health, Government of Pakistan gives this medal to the student who tops in overall performance during the 5 years Pharm. D. courses.

b. Research Fellowships

University of Karachi, the Higher Education Commission and Pakistan Science Foundation grant fellowships for talented students enrolled for M. Pharm., M.Phil. and Ph.D. programs.

c. Scholarships and Fee Remissions

Needy and deserving undergraduate students are given full-fee/half-fee remissions through some of the recently initiated scholarships.

d. Duty Loan

These interest-free loans are granted by Banker's Equity of Pakistan to outstanding and deserving students. Moreover, Pakistan Fauji Foundation and other social and cultural organizations give financial assistance to needy students.

4. Hospital Training

Memorandum of Understanding (MoUs) with hospitals, such as National Institute of Blood Diseases (NIBD), Holy Family, Darulsehat, Liaquat National, Patel, and Children Hospital have been made for professional training of Pharm. D. (Final year) students.

5. Gold Medals

- **Hakimsons Chemical Industries** Gold Medal is awarded to a student, who performs best in the 5 years Pharm. D. degree courses.
- **Prof. S.M.S. Zoha** Gold Medal is awarded to a student who secured best CGPR in Pharmacy at the B. Pharm. / Pharm. D. examinations.
- **Fauzia Rashid** Gold Medal is received by a student who stands first in the Pharm. D. examinations.
- **Amna Feroz** Gold Medal goes to a student who stands first at the B. Pharm. / Pharm. D. examinations.
- **Al-Haj Ikram Siddiqui** Gold Medal goes to the most outstanding M. Pharm. student of the faculty.

Publications

1. Pakistan Journal of Pharmaceutical Sciences

The Pakistan Journal of Pharmaceutical Sciences (PJPS) is the official bi-monthly publication of the Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi. It publishes high quality, peer reviewed articles on related subjects. PJPS has Impact Factor 0.692 and its contents are indexed and abstracted in the Chemical Abstracts, MEDLINE/PubMed, Index Copernicus, Index Medicus, CAB

Abstracts, ISI, Global Health, Pubget, SADCCT, NLM LocatorPlus, GDPBM, IMEMR, SCImago, EVISA, Serial Cited, EBSCO, PDB, IndexPharmacus, AsiaNet, ResearchGate and PakMediNet.

2. **Pakistan Journal of Pharmacology**

Recently the rights and authority of the Pakistan Journal of Pharmacology has been delegated to the Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi. Every year two issues of the journal are published under the supervision of the Dean.

3. **Farmacia**

Faculty of Pharmacy and Pharmaceutical Sciences also publishes a bi-lingual magazine "Farmacia" annually, which comprises articles on various topics on pharmacy as well as covers various activities and events involving students, held in the faculty of Pharmacy and Pharmaceutical Sciences. Farmacia also publishes interviews of the faculty members. This magazine is published on regular basis, and students of faculty of the Pharmacy and Pharmaceutical Sciences participate in it with their articles in both Urdu and English languages.

4. **Graduate Directory**

A graduate directory of the final year students is prepared and published every year. This directory helps the students to seek jobs of their interest as well as pursue their careers as per their choice and ambition.

Admission & Examinations

Under-Graduate Studies

1. **Pharm-D. Admissions**

Admissions in Karachi University are given according to merit. There is no discretionary quota for admissions. However, certain seats are reserved for disabled persons and children of university teachers and employees. For these seats also, admissions are given on the criterion of merit.

Admissions on Merit Seats

Prior to granting admission the students are required to appear in a qualifying test in which it is mandatory to score 50% marks. Since the number of applicants is much higher than the number of available seats, under the University rules the applicants have been divided into three categories i.e. K, S, and P.

- i. Category "K". Preference shall be given to those applicants, who have passed Secondary School Certificate (SSC) and Higher Secondary Certificate (HSC) or equivalent examinations from an educational institution situated in Karachi and also recognized by the University.

Whereas, for admission in Master's degree program, in addition to the SSC and HSC, preference shall be given to those applicants who have also obtained graduation degree from an academic institution affiliated to the University of Karachi. Five percent (5%) seats have been reserved for applicants who have done their

- graduation from a non-public sector, degree awarding institute situated in Karachi and recognized by the University of Karachi.
- ii. Category "S" comprises those applicants who have passed their pre-requisite examinations from a recognized educational institution in the Province of Sindh (excluding Karachi).
 - iii. Category "P" comprises those applicants who have passed their pre-requisite examinations from a recognized educational institution outside the Province of Sindh.

Preference in admissions is given to "K" category candidates. In case seats are left, "S" category candidates are considered. If seats are still available then consideration is given to "P" category candidates.

Change of Category

Candidates who fulfill the following conditions can apply for change of category from S or P to K.

- i. Those students whose father or mother is domiciled in Karachi, but who have passed the requisite examination from any registered National or International Institution outside Karachi or from any Pakistan Board or University which conducts examinations in foreign countries and they have passed their examination from abroad, such candidates will have to produce their father's or mother's domicile certificate with their applications.
- ii. Students whose parents are employees of the Federal or Sindh Governments, or of autonomous or semi-autonomous bodies of Government Corporations, or of the Armed Forces, who have been posted in or transferred to Karachi within the last two years. Such applicants will have to produce the appointment letter or transfer letter of their father/mother together with their applications.
- iii. 3% seats in each department will be allocated for those candidates who have passed their pre-requisite examination from a recognized educational institution located outside Karachi but they have their initial education including Matric/Intermediate from Karachi. Such candidates should have Karachi P.R.C. and their parents should have domicile and N.I.C. of Karachi. Candidates below the age of 18 years are required to submit photocopy of 'B' Form.

Application for Change of Category

All such applicants who fulfill the criteria for change to category K, should attach with their forms an application on plain paper for change of category together with their father's/mother's domicile certificate, NIC and appointment/transfer letter. At the time of admission they will have to produce the original and photo copies of all documents.

Admissions on Reserved Seats

Some seats have been reserved for dependents of Karachi University employees, sports and disabled persons. Candidates for admission to these seats should ensure that they meet the criteria of eligibility for the University as well as the concerned department. The candidates will have to submit a separate form for reserved seats.

The merit list for these seats is prepared for different departments on the basis of recommendations by the concerned Committee. It may be mentioned that certain departments have limited the number of students to be admitted on reserved seats because of the unusually large number of applicants. Admission forms for these seats can be obtained from the office of the Deputy Registrar (Academic).

Conditions for Eligibility

The conditions for eligibility for all candidates, whether for merit seats or for reserved/donor's seats are as under:

For admission in the Faculty of Pharmacy and Pharmaceutical Sciences, the candidate should have obtained minimum of 60 per cent marks (B-Grade) in Intermediate/H.S.C. (Biology Group). Candidates desirous of taking admission on the basis of degrees/certificates other than University of Karachi should get the equivalence of their degrees/certificates determined by the University Equivalence Committee well before the scheduled date of admissions. Candidates passing 'O' Level, 'A' Level or other foreign degrees/certificates should get the equivalence of their grades and marks determined before the scheduled date.

2. Examinations

System of Examination and Grading

1. Terminal Examination

The examination held at the end of semester after the completion of a course is known as Terminal Examination. It will carry 100 marks. This examination's passing head, i.e., a student must obtain a minimum of 50 marks for each course in this examination.

2. Grading System

Grades given to a student in each course is of two types:

a. Numerical Grade (NG)

Assessment of performance on the basis of marks out of 100 fixed for a course of 3 or 2 credit hours unit is NG.

b. Alphabetical Grade (AG)

Equivalent of numerical grades in terms of alphabets shall be termed as alphabetical grades. (Each letter carries a value in terms of numerical points).

c. Grading

Marks (NG)	Grade (AG)	Grade Point
90 & above	A +	4.0
85-89	A	4.0
80-84	A -	3.8
75-79	B +	3.4
71-74	B	3.0
68-70	B -	2.8
64-67	C +	2.4
61-63	C	2.0
57-60	C -	1.8
53-56	D +	1.4
50-52	D	1.0
Below 50	Fails	0.0

d. Incomplete Grade

For incomplete courses no point shall be given.

e. Grade Point Ratio (GPR)

Points obtained in each course shall be multiplied by the number of credit hours specified for that course, and then a grade point ratio (GPR) shall be calculated.

Formula

Grade points in a Course= Credit hours of the course X Grade point equivalent to the score given in the grade point table

f. Cumulative Grade Point Ratio (CGPR)

This is obtained by adding all the Grade Points of the courses during 5 years study period and dividing the total by the total number of credit hours.

$$\text{CGPR} = \frac{\text{Total Grade Points in all the courses}}{\text{Total number of Cr. Hrs.}}$$

3. Requirement for the Award of Pharm. D. Degree

- a. A student must have passed all prescribed courses (Total 70 courses).
- b. A student must have obtained a minimum CGPR 2.45

4. Rules Concerning the Promotion and Repetition of Course

- a. A student would be promoted to next higher class upon clearing 80% of the courses (11 out of 14). In case of any misinterpretation and discrepancy, Deans' Committee would be the final authority in deciding any representation.
- b. If a student is unable to complete the attendance requirement in any course, he/she shall be required to attend the entire course whenever it is offered again. He /She will become eligible for taking the examination in the particular course only after he/she has completed its attendance requirement. Such a student shall pay a prescribed fee for attending the classes as Casual Student.
- c. If a student, after completing the attendance requirement, does not appear or fails in the terminal examination of a course, he/she will be allowed to re-appear not more than twice in the terminal examination when it is offered in the next session after the payment of prescribed examination fee as Repeater Student.
- d. A repeater student who fails to clear a course / courses in three regular, available chances will not be eligible to re-appear. He/She may be allowed as a last chance to attend the classes of the course/courses he/she failed to clear. Permission to appear in the examination will be subject to completing attendance requirements.
- e. (Approved by the Academic Council on 17-3-1999, vide Resolution No.1).

5. Attendance

Attendance in each subject is compulsory for all students and no student shall be eligible to appear at any University examination unless he/she has attended 75 per cent attendance in the course.

- i. The attendance of students admitted in the faculty will be counted from the 1st day of semester and not from the date of admission.
- ii. Students called for national duty such as participation in Olympics, National Games, Inter-varsities, and going to perform Haj would be given exemption in attendance for the actual period of national duty/Haj. These cases would be decided individually.
- iii. If a student is unable to attend classes continuously for 15 days or more without informing the Dean/Chairperson of the Department (in writing) his/her admission will also stand cancelled. In case of illness or other similar situation, application along with a medical certificate from a registered medical practitioner duly verified by the Senior Medical Officer of the University must be submitted within two days after the incident.
- iv. Shortage of attendance may be condoned by 5% by the Chairman of the department for bonafide reasons. The Vice Chancellor may condone a further shortage of 10%

in cases of special hardships, but no student whose attendance falls below 60% shall be sent up for any University examination.

- v. Original attendance register is to be submitted to the Dean/Chairperson for record and future reference.

6. Maximum Duration for Completion of Degree

- i. Degree enrollment of the Pharm. D. will remain valid for two more years after the expiry of the required duration for the completion of the Pharm.D. degree (i.e. 5 years).
- ii. However, a student unable to complete his/her degree requirement within the validity of his/her enrollment, will have to re-validate/extend his/her enrollment for not more than 2 years by paying a prescribed fee with the permission of the Dean.

7. Cancellation of Admission/Readmission

- i. If a student admitted to Pharm.D. 1st year class for the first time and fails to attend the class for the first 15 days, his/her admission shall stand cancelled.
- ii. If a student absents himself/herself for 15 consecutive days during the semester without any information, his/her admission shall also be cancelled. Re-admission would be granted in the same semester by the Dean if he/she can complete his/her attendance requirement.
- iii. If a student is unable to continue his/her studies, his/her admission will be treated as cancelled. He/she may however be re-admitted after the payment of prescribed fee in the same semester where he/she had left. Permission would be granted by the Dean.
- iv. He/she may be allowed 3 chances to pass/get promoted in the next higher class if he/she has completed the attendance requirements.

8. Unfair Means

All the cases of unfair means will be forwarded to the Committee appointed for the purpose and the matter will be dealt with in accordance with the rules and regulations of the University.

9. Interpretation of Semester Rules

The decision of the Deans' Committee would be final for the interpretation of semester rules. In case of any appeal, Deans' Committee would dispose it off on its merits.

10. In the Examination Hall

- i. No candidate shall be admitted into the examination hall without the prescribed admit card and enrolment card, issued by the university. Candidates are liable to expulsion from the examination Hall for failure to produce the University Admit Card, the Enrolment Card and the University Identity Card.
- ii. Do not forget to attach the photocopy of the admit card, which is only the proof of fee-payment.
- iii. No one should smoke inside the examination hall.
- iv. In case of walk-out, there shall be no re-examination under any circumstances.
- v. No materials or electronic devices shall be brought into the room or used at an examination. Unauthorized materials include, but are not limited to: books, class notes, or aid sheets. Unauthorized electronic devices include, but are not limited to: cellular telephones, laptop computers, calculators, MP3 players (such as an iPod), personal digital assistants ("PDA" such as a Blackberry), electronic dictionaries, compact disc players, and mini disc players.

Course Schedule

Pharm. D. First Professional

Course No.	Course Title (First Semester)	Cr. Hours
* PHT-301	Pharmaceutics - Fundamental of Pharmacy	3
** PHC-303	Pharmaceutical Chemistry- Organic	3
*** PHL-305	Pharmacology - Islamic learning/Pak Studies	2
PHL-307	Pharmacology- Physiology & Histology - I	3
PHL-309	Pharmacology- Biochemistry-I	3
PHL-311	Pharmacology- Biochemistry (Practical)	3
PHC-313	Pharmaceutical Mathematics	3
Total Courses 7		Cr. Hrs. 20

Course No.	Course Title (Second Semester)	Cr. Hours
PHT-302	Pharmaceutics - Pharmaceutical Dosage Forms - I	3
PHC-304	Pharmaceutical Chemistry-Organic/Inorganic (Practical)	3
PHC-306	Pharmaceutical Statistics	3
PHL-308	Pharmacology- Physiology & Histology - II	3
PHL-310	Pharmacology- Biochemistry -II	3
**** PHG-312	Pharmacognosy- General Pharmacognosy	3
PHL-314	Pharmacology– Anatomy	2
	English- Compulsory (Non-credit course)^	
Total Courses 7		Cr. Hrs. 20

^ Passing English is Compulsory

- * PHT **Pharmaceutics**
- ** PHC **Pharmaceutical Chemistry**
- *** PHL **Pharmacology**
- **** PHG **Pharmacognosy**

Course Schedule

Pharm. D. Second Professional

Course No.	Course Title (First Semester)	Cr. Hours
PHT-401	Pharmaceutics - Pharmaceutical Dosage Forms - II	3
PHT-403	Pharmaceutics - Microbiology - I	3
PHC-405	Pharmaceutical Chemistry - Physical-I	3
PHL-407	Pharmacology- Physiology & Histology (Practical)	3
PHL-409	Pharmacology-Pharmacology & Therapeutics	3
PHG-411	Pharmacognosy – Herbal Quality Control Lab-I (Practical)	3
PHL-413	Pharmacology- Pathology	2
Total Courses 7		Cr. Hrs. 20

Course No.	Course Title (Second Semester)	Cr. Hours
PHT-402	Pharmaceutics - Pharmaceutical Dosage Forms (Lab)	3
PHT-404	Pharmaceutics - Microbiology - II	3
PHC-406	Pharmaceutical Chemistry - Physical-I (Practical)	2
PHC-408	Pharmaceutical Chemistry - Physical - II	3
PHL-410	Pharmacology- Systemic Pharmacology - I	3
PHG-412	Pharmacognosy - Chemical Pharmacognosy-I	3
PHT-414	Pharmaceutics - Physical Pharmacy	3
Total Courses 7		Cr. Hrs. 20

Course Schedule

Pharm. D. Third Professional

Course No.	Course Title (First Semester)	Cr. Hours
PHT - 501	Pharmaceutics - Microbiology (Lab)	3
PHC - 503	Pharmaceutical Chemistry - Physical-II (Practical)	3
PHC - 505	Pharmaceutical Chemistry - Quality Control	3
PHL - 507	Pharmacology- Systemic Pharmacology - II	3
PHL - 509	Pharmacology - Pathology (Practical)	2
PHG - 511	Pharmacognosy - Chemical Pharmacognosy - II	3
PHT - 513	Pharmaceutics - Computer Application in Pharmacy	2
Total Courses 7		Cr. Hrs. 19

Course No.	Course Title (Second Semester)	Cr. Hours
PHT - 502	Pharmaceutics - Physical Pharmacy (Lab)	3
PHT - 504	Pharmaceutics - Industrial Pharmacy - I (Unit operations)	3
PHC - 506	Pharmaceutical Chemistry - Prep/Q.C. (Practical)	3
PHC - 508	Pharmaceutical Chemistry - Pharmaceutical Analysis - I	3
PHL - 510	Pharmacology- Pharmacology (Practical)	3
PHG - 512	Pharmacognosy - Herbal Quality Control Lab -II (Practical)	3
PHG - 514	Pharmacognosy - Natural Toxins	2
Total Course 7		Cr. Hrs. 20

Course Schedule

Pharm. D. Fourth Professional

Course No.	Course Title (First Semester)	Cr. Hours
***** PHP - 601	Pharmacy Practice - I	3
PHT - 603	Pharmaceutics - Industrial Pharmacy - II	3
PHT - 605	Pharmaceutics - Industrial Pharmacy (Lab)	3
PHC - 607	Pharma. Chemistry - Pharmaceutical Analysis - I (Practical)	3
PHL - 609	Pharmacology - Systemic Pharmacology - III	3
PHG - 611	Pharmacognosy - Advance Pharmacognosy	3
PHT - 613	Pharmaceutics - Pharmaceutical Technology	3
Total Courses 7		Cr. Hrs. 21

Course No.	Course Title (Second Semester)	Cr. Hours
PHP - 602	Pharmacy Practice - II	3
PHT - 604	Pharmaceutics - Biopharmaceutics & Pharmacokinetics	3
PHT - 606	Pharmaceutics - Clinical Pharmacokinetics	3
PHC - 608	Pharmaceutical Chemistry - Pharmaceutical Analysis - II	3
PHC - 610	Pharmaceutical Chemistry - Medicinal - I	3
PHL - 612	Pharmacology - Pharmacology (Practical)	3
PHT - 614	Pharmaceutics - Pharmaceutical Technology (Lab)	3
Total Courses 7		Cr. Hrs 21

***** PHP Pharmacy Practice

Course Schedule

Pharm. D. Fifth Professional

Course No.	Course Title (First Semester)	Cr. Hours
PHT - 701	Pharmaceutics - Biopharmaceutics & Pharmacokinetics (Lab)	3
PHT - 703	Pharmaceutics - Forensic Pharmacy	3
PHP - 705	Pharmacy Practice - III	3
PHC - 707	Pharmaceutical Chemistry - Pharmaceutical Analysis - II (Practical)	3
PHC - 709	Pharmaceutical Chemistry - Medicinal - II	3
PHL - 711	Pharmacology - Clinical Pharmacology	2
PHG - 713	Pharmacognosy - Clinical Pharmacognosy	2
Total Courses 7		Cr. Hrs. 19

Course No.	Course Title (Second Semester)	Cr. Hours
PHT - 702	Pharmaceutics - Prescription & Community Pharmacy	3
PHT - 704	Pharmaceutics - Pharma. Management & Marketing	3
PHT - 706	Pharmaceutics - Prescription Pharmacy (Lab)	3
PHT - 708	Pharmaceutics - Quality Control and Quality Assurance	3
PHC - 710	Pharmaceutical Chemistry - Medicinal - III	3
PHL - 712	Pharmacology - Toxicology	2
PHP - 714	Pharmacy Practice - IV	3
Total Courses 7		Cr. Hrs. 20

Total Courses = 70

Total Credit Hours = 200

Pharm. D.

Deficiency Courses Schedule

(Under Semester System)

Department of **Pharmaceutics**

Course No.	Course Title (First Semester)	Cr. Hours
PHT-513 (D)	Computer Application in Pharmacy	2
PHT-613 (D)	Pharmaceutical Technology	3

Course No.	Course Title (Second Semester)	Cr. Hours
PHT-606 (D)	Clinical Pharmacokinetics	3
PHT-614 (D)	Pharmaceutical Technology (Practical)	3
PHT-702 (D)	Clinical Pharmacy	3
PHT-708 (D)	Pharmaceutical Quality Control and Assurance	2
Total Courses 6		Cr. Hrs. 16

Pharm. D.

Deficiency Courses Schedule

(Under Semester System)

Department of **Pharmaceutical Chemistry**

Course No.	Course Title (First Semester)	Cr. Hours
PHC-303 (D)	Organic and Inorganic Chemistry	2
PHC-505 (D)	Quality Control	2
PHC-707 (D)	Pharmaceutical Analysis	2

Course No.	Course Title (Second Semester)	Cr. Hours
PHC-406 (D)	Physical Chemistry (Practical)	2
PHC-710 (D)	Medicinal Chemistry	3
Total Courses 5		Cr. Hrs. 11

Pharm. D.

Deficiency Courses Schedule

(Under Semester System)

Department of **Pharmacology**

Course No.	Course Title (First Semester)	Cr. Hours
PHL - 711 (D)	Clinical Pharmacology	2
PHL - 715 (D)	Anatomy	2
PHL - 721 (D)	Pathology (Theory & Practical)	3

Course No.	Course Title (Second Semester)	Cr. Hours
PHL - 712 (D)	Toxicology	2
PHL - 718 (D)	Physiology, Histology and Biochemistry (Practical)	3
Total Courses 5		Cr. Hrs. 12

Department of **Pharmacognosy**

Course No.	Course Title (First Semester)	Cr. Hours
PHG - 713 (D)	Clinical Pharmacognosy	2

Course No.	Course Title (Second Semester)	Cr. Hours
PHG - 514 (D)	Natural Toxicants	2
Total Courses 2		Cr. Hrs. 4

Total Courses = 18

Total Credit Hours = 43



Department of Pharmaceutics

The Department of Pharmaceutics is one of the five constituent departments of the Faculty of Pharmacy and Pharmaceutical Sciences. It is the foremost discipline in the pharmaceutical sciences and covers about one-third of the Pharm D curricula, indicating the breadth of the field. Pharmaceutics is a multidisciplinary branch of pharmaceutical science that focuses on the development, design, formulation, and delivery of safe and effective pharmaceutical products. It encompasses a wide range of scientific and technological principles to create medications and dosage forms that optimize the delivery of active pharmaceutical ingredients (APIs) to patients. The Department of Pharmaceutics at the University of Karachi is comprised of a diverse and dedicated team of individuals who contribute to the academic and operational excellence of the department. With a total of 14 esteemed faculty members and 13 non-teaching staff, the department embodies a collaborative and vibrant environment that fosters innovation, research, and education. The department offers 23 courses out of a total 71 courses being offered by the faculty for the Pharm.D. program. The department also offers postgraduate course-work based MS, and research intensive, M. Phil. and Ph.D. programs. To date, the department has produced nearly 125 M. Phil., 187 M. Pharm, and 80 Ph.D. graduates in different disciplines of pharmaceutics.

Laboratory and Classroom Facilities Career Opportunities

All the laboratories are well equipped with advanced and sophisticated industrial and analytical equipment. The classrooms are also furnished with modern facilities such HD enabled multimedia and audio systems. Following are the laboratories with specialized facilities at the Department of Pharmaceutics.

- Natoli® tableting and industrial laboratory
- Formulation development laboratory
- Pharmaceutical technology laboratory
- Industrial pharmacy laboratory
- Pharmaceutical analysis/bioanalysis laboratory
- Physical pharmacy and biopharmaceutics laboratory
- Pharmaceutical microbiology laboratory
- Computer laboratory
- Simulation laboratory (under development)

Specific Research Areas

The Department of Pharmaceutics is actively involved in the following research areas:

- Solid-state pharmaceutics
- Pharmaceutical microbiology
- Microneedles and transdermal drug delivery systems
- Conventional and innovative modified-release oral formulations (osmotic-controlled, pellets and gastro-retentive tablets etc.) and immediate release drug delivery system (oral films, mouth dissolving tablets, orally disintegrating tablets, mouth dissolving pellets etc.)
- Intranasal drug delivery systems
- Biopharmaceutics and pharmacokinetics (bioavailability and bioequivalence studies)

Population and clinical pharmacokinetics, and physiologic-based pharmacokinetics (PBPK)

The scope of pharmacists is vast and dynamic, encompassing a wide array of roles that have a profound impact on healthcare and the pharmaceutical industry. As integral members of the healthcare team, pharmacists play a pivotal role in ensuring patient safety, accurate medication management, and optimal treatment outcomes. In community settings, pharmacists serve as frontline healthcare providers, offering expert guidance on medication usage, potential side effects, and drug interactions. In hospitals and clinics, they collaborate closely with medical professionals to devise personalized medication regimens, monitor patient responses, and mitigate potential risks. Beyond patient care, pharmacists occupy crucial positions within the pharmaceutical industry. They contribute significantly to drug and product research, development, and testing, striving to innovate and enhance therapeutic options. Pharmacists also engage in quality control, regulatory compliance, and pharmaceutical marketing, ensuring that medications meet the highest standards of safety and efficacy. Moreover, pharmacists excel in academia and research, driving scientific exploration, mentoring aspiring professionals, and advancing pharmaceutical knowledge. With their profound expertise, they also navigate the realms of informatics and technology, optimizing pharmacy information systems and healthcare technologies for improved patient care. The Department of Pharmaceutics at the University of Karachi not only imparts comprehensive pharmaceutical education but also nurtures the skills necessary for diverse roles. Graduates are well-equipped to excel as pharmacists, shaping healthcare delivery, pioneering research, and driving innovation within the pharmaceutical landscape, both locally and globally.

For Further Enquiry

Website:

www.uok.edu.pk/faculties/pharmaceutics/index.php

Email: pharmaceutics@uok.edu.pk

Faculty

Pharmaceuticals



Dr. Muhammad Harris Shoaib

Dean and Professor

Qualification

**Ph.D., M.Phil., B.Pharm.
(University of Karachi)**

Year of Association

2000

Subjects of Interest

**Formulation Development,
Bio-pharmaceutics, Clinical
Pharmacokinetics, Dosage Form Design**

Area of Research Interest

**Clinical Pharmacokinetics, Formulations
Development, Bio-pharmaceutics, Dosage
Form Design**

Email

mhshoaib@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252



Dr. S. M. Farid Hassan

Associate Professor and
Chairman (2024)

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association

2006

Subjects of Interest

**Biopharmaceutics, Pharmacokinetics and
Physical Pharmacy**

Area of Research Interest

**Bioavailability, Bioequivalence,
Pharmacokinetics, Formulation, Product
Development, Optimization with Emphasis
on Solubility Enhancement of Poorly
Soluble Drugs and Novel Drug Delivery
System**

Email

smfhassan@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252



Dr. Rabia Ismail Yousuf

Associate Professor and
Chairperson (2023)

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association

2006

Subjects of Interest

**Pharmacokinetics, Formulations
Development and Optimization,
Biopharmaceutics, Clinical Pharmacy**

Area of Research Interest

**Pharmacokinetics, Formulations
Development and Optimization,
Biopharmaceutics, Clinical Pharmacy**

Email

riyousuf@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252

Faculty

Pharmaceutics



Dr. Iyad Naeem Muhammad

Associate Professor & Coordinator of Pharmacy Practice department

Qualification

Ph.D., M. Phil., B. Pharm., B.Sc. (University of Karachi)

Year of Association

2006

Subjects of Interest

Pharmaceutical Sciences, Pharmaceutical Microbiology, Hospital Pharmacy, Pharmaceutical Technology, Pharmacokinetics, Formulation Development

Area of Research Interest

Pharmacokinetics, Formulation Development, Pharmaceutical Biotechnology, Pharmaceutical Microbiology

Email

iyadnaeem@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252



Dr. Farya Zafar

Associate Professor

Qualification

Ph.D., M. Phil., B. Pharm. (University of Karachi)

Year of Association

2016

Subjects of Interest

Formulation Development, Pharmacokinetics, Bio-Pharmaceutics

Area of Research Interest

Formulation Development, Pharmacokinetics, Bio-Pharmaceutics and Novel Drug Delivery System

Email

farya.zafar@ku.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252



Dr. Sabahat Jabeen

Assistant Professor

Qualification

Ph.D., M. Phil., B. Pharm. (University of Karachi)

Year of Association

2006

Subjects of Interest

Physical Pharmacy, Formulation Development and Drug Stability

Area of Research Interest

Formulation Development, Physical pharmacy, Pharmacokinetics and Drug Stability

Email

sabahatjabeen_uok@hotmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2252

Faculty

Pharmaceuticals



Rehana Saeed

Assistant Professor

Qualification

**M.Phil., B. Pharm.
(University of Karachi)**

Year of Association

2006

Subjects of Interest

Pharmaceutical Microbiology, Dosage Form, Pharmacokinetics and Formulation Development

Area of Research Interest

Pharmacokinetics, Formulation Development, Hospital Pharmacy and Clinical Pharmacy

Email

rehanakurian@gmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2252



Dr. Faaiza Qazi

Assistant Professor (T)

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association

2016

Subjects of Interest

Pharmaceutical Technology and Industrial Pharmacy, Pharmacokinetics, Formulation Development, Clinical Pharmacy and Pharmacy

Area of Research Interest

Formulation Development, Clinical Pharmacy, Pharmacokinetics, Pharmacy Practice, Drug Stability

Email

fqazi@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252



**Dr. Farrukh
Rafiq Ahmed**

Assistant Professor (T)

Qualification

**Ph.D., B. Pharm., Pharm. D.
(University of Karachi)**

M.S. (GIST, South Korea)

Year of Association

2006

Subjects of Interest

Pharmaceutical Technology, Biopharmaceutics, Pharmaceutical Nanotechnology

Area of Research Interest

Formulation Designing, Nanomedicine, Population Pharmacokinetics

Email

farrukh.ahmed@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252

Faculty

Pharmaceuticals



**Dr. Kamran
Ahmed**

Assistant Professor (T)

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association

2016

Subjects of Interest

**Novel Drug Delivery System,
Pharmacokinetics**

Area of Research Interest

**Formulation and Development of Drug
Delivery System**

Email

Kamran.ahmed@hotmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2252



**Dr. Sadaf
Farooqi**

Lecturer

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association

2016

Subjects of Interest

**Pharmaceutical Biotechnology,
Formulation Development,
Bio-Pharmaceutics, Pharmaceutical
Microbiology**

Area of Research Interest

**Novel Drug Delivery system, Drug Delivery
Disposition and Dynamics, Pharmaceutical
Microbiology, Quality Use of Medicine**

Email

sadaf.farooqi@uok.edu.pk

sfarooqi147@hotmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2252



**Dr. Tazeen
Husain**

Lecturer

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association

2006

Subjects of Interest

**Formulation Development, Pharmaceutical
Biotechnology, Biopharmaceutics, Drug
Stability, Pharmacy Practice, Pharmaceutical
Microbiology**

Area of Research Interest

**Formulation Development, Novel Drug
Delivery System, Pharmaceutical
Microbiology, Pharmacy Practice**

Email

tznhusain@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252

Board of Studies

Prof. Dr. Muhammad Harris Shoab
Professor

Dr. S. M. Farid Hasan
Associate Professor and Chairman (2024)

Dr. Rabia Ismail Yousuf
Associate Professor and Chairperson (2023)

Dr. Iyad Naeem Muhammad
Associate Professor

Dr. Farya Zafar
Associate Professor

Ms. Rehana Saeed
Assistant Professor

Ms. Sadaf Farooqi
Lecture

Dr. Syed Jamshaid Ali Kazmi
Vice Chancellor,
Sohail University, Karachi

Prof. Dr. Abdullah Dayo
Dean, Faculty of Pharmacy,
University of Sindh, Jamshoro.

Dr. Anwar Ejaz Beg
Professor of Pharmaceutics and Advisor to Chancellor,
Faculty of Pharmacy, Ziauddin University, Karachi.

Dr. Zafar Alam Mehmood
Country Manager,
Colorcon (Pv.t) Ltd., Karachi

Pharm. D. Courses

First Professional					
1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHT-301	Pharmaceutics - Fundamental of Pharmacy	3	PHT-302	Pharmaceutics - Pharmaceutical Dosage Forms - I	3
Second Professional					
PHT-401	Pharmaceutics - Pharmaceutical Dosage Forms - II	3	PHT-402	Pharmaceutics - Pharmaceutical Dosage Forms (Lab)	3
PHT-403	Pharmaceutics - Microbiology - I	3	PHT-404	Pharmaceutics - Microbiology - II	3
			PHT-414	Pharmaceutics - Physical Pharmacy	3
Third Professional					
PHT-501	Pharmaceutics - Microbiology (Lab)	3	PHT-502	Pharmaceutics - Physical Pharmacy (Lab)	3
PHT-513	Pharmaceutics - Computer Application in Pharmacy	2	PHT-504	Pharmaceutics - Industrial Pharmacy - I (Unit Operations)	3
Fourth Professional					
PHT-603	Pharmaceutics - Industrial Pharmacy - II	3	PHT-604	Pharmaceutics - Biopharmaceutics and Pharmacokinetics	3
PHT-605	Pharmaceutics - Industrial Pharmacy (Lab)	3	PHT-606	Pharmaceutics - Clinical Pharmacokinetics	3
PHT-613	Pharmaceutics - Pharmaceutical Technology	3	PHT-614	Pharmaceutics - Pharmaceutical Technology (Lab)	3
Fifth Professional					
PHT-701	Pharmaceutics - Bio-Pharmaceutics and Pharmacokinetics (Lab)	3	PHT-702	Pharmaceutics - Prescription and Community Pharmacy	3
PHT-703	Forensic Pharmacy	3	PHT-704	Pharmaceutics - Pharmaceutical Management and Marketing	3
-	-	-	PHT-706	Pharmaceutics - Prescription Pharmacy (Lab)	3
			PHT-708	Pharmaceutics - Quality Control and Quality Assurance	3
Total 22 Courses making 68 Credit Hours in five years					

First Semester

Pharmaceutics - Fundamental of Pharmacy

PHT- 301
Cr. Hrs. 3

1. Pharmacy Orientation

Introduction and orientation to the profession of pharmacy in relation to hospital pharmacy, retail pharmacy, industrial pharmacy, forensic pharmacy, pharmaceutical education and research etc.

2. History of Pharmacy

A survey of the history of pharmacy through ancient, Greek and Arab periods with special reference to contribution of Muslim scientists to pharmacy and allied sciences. Introduction to literature of pharmacy.

3. Literature of Pharmacy

Pharmacopocia, formularies, codices, abstracts, etc.

4. Physico-chemical Process

Precipitation, crystallization, evaporation, distillation, efflorescence deliquescence, lyophilization, elutriation, exication, descication, ignition, fusion, sublimation, calcination, decantation, adsorption, centrifugation, tirturation, levigation, dialysis, extraction, (maceration, percolation, infusion, decoction, digestion)

Books Recommended

1. Martin, P., Bustamante, P. and Chun, A.H.C Physical and Chemical Principles of Pharmaceutical Science, 4th Edition, New York (1999).
2. Aulton, M.E. Pharmaceutics: The Science of Dosage Form Design. 2nd Edition, Harcourt Publisher (2002).
3. Rawlins E.A. (ed.), Berdley's Textbook of Pharmaceutics, 8th (or recent edition). Macmillan Publishing Co. Inc. New York (1977).
4. Banker G.S. and Rhodes C.T. Modern Pharmaceutics, 4th Edition (Revised and expanded), Marcel Dekker, Inc. New York (2002).
5. Carstensen J.T. and Rhodes C.T. (ed.) Drug Stability: Principles and Practices, 3rd edition (revised and expanded), Merceel Dekker, New York (2000).

Pharmaceutics - Pharmaceutical Dosage Forms - II

PHT-401
Cr. Hrs. 3

Non - Galenicals - Solid Dosage Forms

1. Powders: Definition, properties, advantages, disadvantages, types and preparation etc.
2. Tablets: Definition, types, essentials, advantages, disadvantages, formulation, manufacture, evaluation etc.
3. Capsules: Definition, advantages, disadvantages, types etc.
4. Miscellaneous: Suppositories, surgical dressings, glycerogelatins, medicated pencils, cements etc.

Non-Galenical – Semi-solid Dosage Forms

1. Ointment: Definition, ointment bases, preparation, dispensing etc.
2. Miscellaneous: Creams, pastes, poultices, plasters etc.

New Dosage Forms

Introduction of new dosage forms, drug delivery system and cosmetology.

Books Recommended

1. Anya M. Hellery, Andrew W. Lloyd, James Swarbrick. Drug Delivery and Targeting. For Pharmacist and Pharmaceutical Scientist. Taylor and Francis Publications. (2001).
2. Joseph R. Robinson. Controlled Drug Delivery. Marcel Dekker Publications. (1997)
3. Ramabhadran T.V. Pharmaceutical Design and Development.
4. Aulton M.E. Pharmaceuticals. The Science of Dosage Forms Design.. Harcourt Publications Second Edition (2002).
5. Gilbert S. Banker. Modern Pharmaceutics, Marcel Dekker Publishing, Fourth Edition, (2002).
6. Loyd V. Allen, Jr. Howard C. Ansel. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. 10th Edition. Lippincott Williams E Wilkins.

Pharmaceutics - Microbiology - I

PHT-403
Cr. Hrs. 3

1. General Microbiology

Historical introduction, scope of microbiology with special reference to pharmaceutical sciences. Nomenclature in classification of micro-organisms including virus, rickettsia, bacteria, fungi and protozoa.

2. Bacteria

Classification of bacteria, cell structure, morphology and functions, growth factors, growth characteristics and growth curve, nutritional requirement and nutritional factors effecting growth, Different type of media and staining procedures.

3. Immunology

Definitions, classifications and cellular basis of immune response, immunity, auto-immunity and tolerance. Antigen, antibody, antigen antibody reactions and their clinical and diagnostic applications. Hypersensitivity and allergy and drug allergy mechanisms. Graft reaction, autoimmune disease.

4. Infections

Study of infections caused by following bacterial genera: *Staphylococcus*, *Streptococcus*, *Salmonella*, *Cholera*, *Mycobacterium*, *Helicobacter*. Various viral and rickettsial infections including rabies, hepatitis, AIDS and other emerging pathogens. Rickettsial infections including leishmania and protozoal infections including malaria and others. Normal flora of human body.

5. Microbiology of Air, Water and Soil

Books Recommended

1. Pommerville J.C., Alcamo's Fundamentals of Microbiology, Ninth Edition. Jones and Bartlett Publications.
2. Jawetz, Melnick and Aldelberg's Medical Microbiology, McGraw Hill Lange Publication, 26th Edition.

- Greenwood D, Barer M, Slack R, Irving W. Medical Microbiology. A Guide to microbial infections. Churchill Livingstone. Eighteenth Edition.
- Tortora. G. J, Funke B.R, Case C.L. Microbiology an Introduction. Twelfth Edition. Pearson Education.

Pharmaceutics - Microbiology (Lab)

PHT-501
Cr. Hrs. 3

Practical Elaborating Theory Course

- Sterilization of glassware and pharmaceutical products by various methods.
- Preparation of general and selective media and culturing of microorganism.
- Total and viable counts of microorganisms, morphological and selective biochemical characteristics of some species.
- Staining of bacteria: Gram method, acid fast, Grams staining, capsule staining, flagella and spore staining.
- Microbiological analysis of air, water and soil.
- Microbial evaluation of pharmaceutical products.
- Microbiological assays of antibiotics and vitamins.
- Pyrogen test, sterility test, toxicity test

Books Recommended

- Pommerville J.C., Alcamo's Fundamentals of Microbiology, Ninth Edition. Jonnes and Bartlett Publications.
- Greenwood D, Barer M, Slack R, Irving W. Medical Microbiology. A Guide to microbial infections. Churchill Livingstone. Eighteenth Edition.
- Tortora. G. J, Funke B.R, Case C.L. Microbiology an Introduction. Twelfth Edition. Pearson Education.

Pharmaceutics - Computer Application in Pharmacy

PHT-513
Cr. Hrs. 2

- Introduction** to Microsoft Windows and its different packages like MS Word, Excel, PowerPoint and Access.

2. Internet and Email

Internet and Microsoft internet explorer 5, searching the internet, e-mail and news group, favorites, security and customizing explorer.

3. Web Page Development

Introduction to front page, creating a first web site, basic formatting technique, manipulating tables within front page, FrontPage, pictures and multimedia, hyperlinking, bookmarks and image maps, front page and frames, managing your web, good site design.

- Complete Statistical Packages**, Statistica®
- Languages** at least two prevailing languages will be taught.

Books Recommended

- Introduction to computers
- Windows XP 2004,
- Teach Yourself Visually MS Word® Lisa A. Bucki. 2007
- Teach Yourself Visually MS Power Point® Lisa A. Bucki. 2007

5. Teach Yourself Visually MS Excel® Lisa A. Bucki. 2007
6. Columbus, L., 2008. The MS-Windows XP Professional Handbook. Firewall Media.
7. Introduction to computers, Windows 7, MS office XP.

Pharmaceutics - Industrial Pharmacy - II

PHT-603
Cr. Hrs. 3

1. Pharmaceutical Lay Out and Plant Designing

General layout and plant designing of the Pharmaceutical Industry Pharmaceutical plant construction, nature and properties of important materials employed in construction and erection of plant, convenience and storage of raw materials, semi-finished and finished product.

2. Design of Sterile Area

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.)

3. Heat Transfer

4. Mass Transfer

Safety methods in pharmaceutical industry.
Mechanical, chemical, and fire hazards problems, inflammable gases and dusts.

5. Packaging Technology

Influence of packaging materials, stability, packaging lines, packaging area, and packaging equipment.

6. Equipments Used for:

Patches, sprays, implants, sutures, plasters, sachet packing.

7. Study Tour

A visit of the pharmaceutical industry and training will be an integral part of syllabi

Books Recommended

1. Martin, P., Bustamante, P. and Chun, A.H.C. Physical and Chemical Principles of Pharmaceutical Science, 4th Edition, New York (1999).
2. Aulton M.E. Pharmaceutics. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).
3. Rawlins E.A. (ed.) Berdley's Textbook of Pharmaceutics, 8th (or recent edition), Macmillan Publishing Co. Inc. New York (1977).
4. Banker G.S. and Rhodes C.T. Modern Pharmaceutics, 4th Edition (Revised and expanded), Marcel Dekker, Inc. New York (2002).
5. Carstensen J.T. and Rhodes C.T. (ed.) Drug Stability: Principles and Practices, 3rd edition (revised and expanded), Marcel Dekker, New York (2000).

Pharmaceutics - Industrial Pharmacy (Lab)

PHT-605
Cr. Hrs. 3

1. **Manufacture of Tablets by**

Wet granulation method, manufacture of tablets by slugging, manufacture of tablets by direct compression method.

2. **Coating of Tablets**

Sugar coating, film coating, enteric coating.

3. **Clarification of liquids by various processes**

Size reduction, homogenization.

Ampoule filling, sealing and sterilization clarity and leakage tests in injectable.

Capsule filling by semi-automatic machines.

4. **Manufacture of sustained action drugs**

5. **Tablets tests**

Disintegration, dissolution, friability, hardness and thickness tests. Determination of weight variation in tablets. Density of powder. Particle size analysis.

6. **Content uniformity test**

Using HPLC technique, relative humidity and moisture content determination.

Books Recommended

1. Aulton M.E. Pharmaceutics. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).
2. Banker G.S. and Rhodes C.T. Modern Pharmaceutics, 4th Edition (Revised and expanded), Marcel Dekker, Inc. New York (2002).

Pharmaceutics - Pharmaceutical Technology

PHT-613
Cr. Hrs. 3

1. **Barriers to Drug Delivery Systems (DDS)**

- a. Oral, IV, IM, Rectal, Pulmonary DDS
- b. Reticulo-endothelial system

2. **Principles of Non-Targeting/Conventional Pharmaceutical Formulations and Dosage Form Design**

- a. Need, product formulation and preformulation studies
- b. Formulation development of Aerosols, Ophthalmic and Parenteral Preparations
- c. Formulation development of Osmotic, Sustained-Release, Rapidly Disintegrating, Gastro-retentive drug delivery systems.

3. **Concept of Targeting DDS**

- a. Active vs. Passive Targeting
- b. Targeting Strategies
 - a. Environment and stimuli sensitive targeting: pH, temperature, ions, photo, magnetic, ultrasound, etc.
 - b. Regulated systems: enzyme complex etc
 - c. Ligand based targeting: Polymeric conjugates, biomacromolecular conjugates like antibody, affibody, aptamer and peptides etc

4. **Introduction and Types of Various Dosage Forms and DDS**

- a. Nanoparticles, nanospheres, dendrimers, nanohydrogels, liposomes, niosomes, gold and iron oxide nanoparticles
- b. Brief over view of theragnostic systems

5. **Principles of Formulation of Novel Drug Delivery Systems**
 - a. Introduction and brief overview of biomedical polymers, their physical and structure-property relationship.
 - b. Examples of bio-responsive and stimuli responsive polymers
 - c. Overview of methods to formulate polymeric nanoparticles, dendrimers, liposomes, niosomes, hydrogels and gold nanoparticles etc
 - d. Selection of ligands for delivery system with examples to targeting substrates
 - e. Formulation stability issues associated with novel DDS
6. **Characterization Techniques for Novel DDS**
 - a. Spectrophotometric (FT-IR, HPLC, UV, Fluorescence-spectroscopy, NMR etc)
 - b. Particles size characterization (SEM, TEM, DLS, Size-exclusion chromatography etc)
 - c. Crystalline Structure (XRD etc)
 - d. Miscellaneous techniques (AFM, Raman-spectroscopy etc)
7. **Pharmacokinetic and pharmacological aspects of novel DDS**
 - a. Clearance and in-vivo stability of novel DDS
 - b. Concept and strategies of designing long-circulating DDS
 - i. Phenomena of surface shape, charge, size and nature
 - ii. Effect of poly-ethylene glycol (PEG) and other long circulating polymers
 - c. Toxicity patterns of colloidal and novel drug delivery systems.
8. **Drug and Disease Candidates for Novel DDS**
 - a. Principles of selection of a disease
 - b. Principles of selection of drug(s) candidates for a disease
9. **Commercial Benefits and Applications of Novel Drug Delivery Systems**
 - a. Pharmaco-economic considerations
 - b. Advantages of novel DDS
 - c. Examples of commercialized novel DDS
10. **Introduction to Pharmaceutical Bio-Technology**
 - a. Introduction to basic science and application of biotechnologically derived pharmaceutical products (antibiotics, amino acids, insulin, enzymes and vaccines etc.), scope application new findings.
 - b. Role of Pharmaceutical Biotechnology in the new product development (NPD), challenges and opportunities.
11. **Isolation and identification of suitable strains and their maintenance.**
 - a. Genetic techniques for the strain improvement.
 - b. Effect of certain Bio-chemical parameters, media composition and process optimization
 - c. Isolation, extraction and purification techniques for the desired biopharmaceuticals.
 - d. Upstream and downstream processes.
 - e. Area design and quality requirements during manufacturing of biopharmaceutical.
 - f. Commercial implications of recombinant DNA technology.
 - g. The concept of gene therapy to cure genetic diseases.
12. **Pharmaceutical Biotechnology and Health with special reference to treatment of cancer and possibly AIDS.**

Books Recommended

1. Gilbert S. Banker, Modern Pharmaceutics, Marcel and Dekker Publishing (2002)
2. Pharmaceutical Biotechnology: Fundamentals and Applications – October 22, 2013 by Daan J. A. Crommelin (Editor), Robert D. Sindelar (Editor), Bernd Meibohm (Editor).
3. Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications – May 21, 2012, by Oliver Kayser (Editor), Heribert Warzecha (Editor).
4. Pharmaceutical Biotechnology: Concepts and Applications [Kindle Edition], Gary Walsh (Author).
5. Pharmaceutical Biotechnology: Concepts and Applications [Kindle Edition], Gary Walsh (Author).
6. "Drug Delivery: Engineering Principles for Drug Therapy" Edited by W. Mark Saltzman, Oxford University Press, Montreal Canada. (2001)
7. "Cellular Drug Delivery: Principles and Applications" Edited by D. Robert Lu and Svein Øie, Humana Press, Springer Science, New York, USA. (2004)

8. "Biomaterials Science: An Introduction to Materials in Medicine", Third Edition by Buddy A. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons, Academic Press, Elsevier, Amsterdam, The Netherlands. (2013)
9. "Nanochemistry" by G. B. Sergeev, Elsevier Science, Amsterdam, The Netherlands. (2006).
10. Recent Review and tutorial articles published in high impact journals like Nature and Nature sister journals.

Pharmaceutics - Biopharmaceutics & Pharmacokinetics (Lab)

PHT-701
Cr. Hrs. 3

1. **To classify 4 Model drugs into respective classes of "Biopharmaceutics Classification System" according to FDA guidelines: (5 Practical to be performed)**
 - a. Construction of standard curve of 4 model drugs by UV-visible spectroscopy
 - b. Construction of pH-Solubility profile of 4 model drugs at pH 1.2, 4.5 and 6.8
 - c. Calculation of pKa of 4 model drugs by Handerson-Hasselbalch equation
 - d. Determination of logP values by shake flask method and calculation of logD (pH 1.2, 4.5 and 6.8) values of 4 model drugs
 - e. Determination of "dissolution rate" of 4 model drugs in 30 mins by USP method I and II

Activity after 5 experiments
Finally, students should discuss the results of 5 experiments and predict the Biopharmaceutics classes of the drugs their absorption site in GIT and formulation priority for the respective drugs.
2. **To estimate pharmacokinetic parameters using plasma drug concentration vs. time curve on semi-log graphs (manually) and comparison with parametric values obtained through data plotting and estimation by PK solver.** [Each practical shall involve manual as well as software-based PK calculations and then comparative assessment of parameters obtained from two methods] (Total of 8 Experiments)
 - a. IV bolus administration
 - i. Non-compartment
 - ii. One-compartment
 - iii. Two-compartment
 - iv. Three-compartment
 - b. Oral administration
 - i. Non-compartment
 - ii. One compartment
 - c. IV infusion
 - d. Urinary Excretion Data
3. **To estimate oral pharmacokinetic parameters using plasma drug concentration vs. time curve after oral administration by Wagner-Nelson method.**
4. **To perform IVIVC determination of 2 model drugs data (dissolution and in-vivo)**
 - a. By Convolution method
 - b. By De-convolution method
5. **To prepare plasma samples for HPLC based analysis of 2 model drugs (high soluble and low soluble).**
6. **Introduction and performance on WinNonLin using PK data of 2 model drugs**
7. **To determine 'plasma protein binding' of 2 model drugs by:**
 - a. Gravimetric Method
 - b. Spectrophotometric Method
 - c. Other Relevant Method

8. **To perform Clinical Pharmacokinetics based “Therapeutic Drug Monitoring” of model drugs according to established relevant clinical guidelines.**
 - a. Manual calculations-based studies.
 - b. Software based (JKPD) development of “user defined model” and application
 - i. Vancomycin
 - ii. Gentamicin
 - iii. Cyclosporin
 - iv. Digoxin
 - v. Phenytoin
 - vi. Theophylline
 - vii. Carbamazepine

Books Recommended

1. Hedaya, M. A. (2024). Basic Pharmacokinetics (3rd ed.) Routledge. Taylor & Francis Group. <https://doi.org/10.4324/9781003161523>
2. Batchelor, H. (Ed.). (2022). Biopharmaceutics: From Fundamentals to Industrial Practice (1st ed.). John Wiley & Sons.
3. Talevi, A., Quiroga, P. A., and Quiroga, P. A. (2024). ADME Processes in Pharmaceutical Sciences: Dosage, Design, and Pharmacotherapy (2nd ed.). Springer. <https://doi.org/10.1007/978-3-031-50419-8>
4. Murray P. Ducharme, and Leon Shargel (2022). Shargel and Yu's Applied Biopharmaceutics and Pharmacokinetics, (8th ed.). McGraw-Hill Education.
5. Kevin M.G. Taylor, Michael E. Aulton (Eds.) (2021). Aulton's Pharmaceutics. The Design and Manufacture of Medicines (6th ed.). Elsevier.
6. Boroujerdi, M. (2023). Handbook of Pharmacokinetics and Toxicokinetics. (2nd ed.) United Kingdom: CRC Press.
7. Franz J. Hock, Michael K. Pugsley. (Eds.) (2024) Drug Discovery and Evaluation: Safety and Pharmacokinetic Assays. (Third Edition). Switzerland: Springer International Publishing.
8. Denton, P., Rostron, C. (Eds.) (2013). Pharmaceutics: The Science of Medicine Design. United Kingdom: OUP Oxford.
9. Mukherjee, B., (2022). Pharmacokinetics: basics to applications. (1st ed.). Springer.

Pharmaceutics - Forensic Pharmacy

PHT-703
Cr. Hrs. 3

1. **Study of Drug Laws**
The Drugs Act 1976 and rules framed there under. Provincial drug rules (Respective Drug Rules will be taught in the relevant province). Advertisement rules. Other related rules and Legal aspects.
2. **The Pharmacy Act 1967 and Amendate Pharmacy Act of 1971**
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**

Books Recommended

1. The Manual of Drug Laws in Pakistan.
2. The Factory Law (1934).
3. Shop and Establishment Ordinance (1969).
4. Control of Narcotics Substances Act (1997).

Second Semester

Pharmaceutics - Pharmaceutical Dosage Forms - I

PHT-302
Cr. Hrs. 3

1. Classification of Pharmaceutical Dosage Forms

Significance of classification, different classifications based on the following; methods of preparation. Galenicals and non-galenicals preparations, sterile and non-sterile preparations. Physical classification, pharmacological classification, classification according to mode of application, Pharmaceutical classification according to release of drug, conventional dosage forms, time release products, repeat action products, prolonged action products, sustained released products, classification according to name of manufactures.

2. Pharmaceutical Dosage Forms

Galenical liquid aqueous dosage forms

Infusions, decoctions, galenical liquid non-aqueous dosage forms, alcoholic dosage forms (tinctures, fluid extracts), oleagenous dosage forms (oleoresins, infused oils), galenical solid dosage forms. Extracts, resins.

Non galenical aqueous liquid dosage forms

Aqueous dosage forms, waters, diluted acids solutions, douches, enemas, gargles, washes, juices, ophthalmic solutions. Sweet viscid aqueous dosage forms, syrups, honeys, mucilages, jellies, aqueous suspensions, suspensions, mixtures, magmas, gels, lotions.

Non-galenical non-aqueous dosage forms

Alcoholic solutions, spirits, elixirs, dental liniments, ethereal solutions (collodions), glycerine solution (glycerites), oleagenous dosage forms (oleovitamins, toothache drops, inhalations, sprays, liniments, emulsions.

3. Parenterals

Definition, history, types, advantages, disadvantages, uses, parenteral production area, containers and closures vehicles, pyrogens, requirements, manufacturing, testing etc.

Books Recommended

1. Aulton M.E. Pharmaceutics. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).
2. Rawlins E. A. (ed.). Bentley's Textbook of Pharmaceutics, 8th (or recent edition). Macmillan Publishing Co. Inc. New York (1985).
3. Alfonso R Gennaro. Remington The Science and Practice of Pharmacy 20th Edition. Mack Publishing Company. (2002).
4. Winfield J. and Richards RME. Pharmaceutical Practice. Second Edition. Prentice Hall Publishing. (2004).

Pharmaceutics - Pharmaceutical Dosage Forms (Lab)

PHT-402
Cr. Hrs. 3

Practical Elaborating Theory Course

Preparation of simple syrups, emulsions. Ointments, lotions, throat paints, glycerites, liniments, sprits, poultices, granules.

Books Recommended

1. Aulton M.E. Pharmaceutics. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).
2. Rawlins E. A. (ed.). Bentley's Textbook of Pharmaceutics, 8th (or recent edition). Macmillan Publishing Co. Inc. New York (1985).

Pharmaceutics - Microbiology - II

PHT-404
Cr. Hrs. 3

1. Sterilization and Disinfection

Methods of sterilization and disinfection, mechanism of killing. Kinetics of death of micro-organism, evaluation of sterilization and disinfection procedures.

2. Fermentation

Fermentation and respiration, ranges of fermentation, parameters of fermentation. Production of pharmacologically active fermentation products, selection of a suitable medium, isolation and recovery, kinetics of microbial growth, continuous culture application in fermentation, engineering aspect of fermentation.

3. Biologicals

Vaccines, classification of vaccines, production of vaccines and antisera. DNA recombinant technology for preparing vaccines Hormones and other biologicals. Pyrogen, sterility and toxicity tests.

4. Antibiotics

Definitions, classification of antibiotics, mode of actions, antimicrobial spectrum and side effects of different groups of antibiotics.

5. Factory and Hospital Hygiene

Introduction, control of microbial contamination during manufacturing, manufacturing of sterile products.

Books Recommended

1. Hugo W.B. and Russell A.D. Pharmaceutical Microbiology.
2. Prescott and Dunn Industrial Microbiology.
3. Daan JA Crommelin, Robert D Sindelar. Pharmaceutical Bio-technology. An Introduction for Pharmacist and Pharmaceutical Scientist. Harwood Academic Publishers. (1997).
4. Pelczar and Chan Microbiology.
5. Meckallee M. Microbiology Essentials and Applications by Collen and Lynes. Microbiology Methods.

Pharmaceutics - Physical Pharmacy

PHT-414
Cr. Hrs. 3

1. Physico-chemical Principles

Solutions: Introduction, types, concentration expressions ideal and real solution, colligative properties, their mathematical derivations and application in Pharmacy, molecular weight determinations, distribution co-efficient and its applications in Pharmacy solubilization, solubility factor affecting solubility. HLB-value, surfactants, their properties and types. Micelles, their formulation and types, ionization. pH, pH indicators, pKa, buffer's equation. Isotonic solutions and their applications in pharmacy.

2. Micromeritics

Particle size and shapes, distribution of particles methods of determination of particle size and importance of particle size in pharmacy.

3. Dispersion

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.

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

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

Adsorption: Techniques and processes of adsorption in detail.

4. Rheology

Definition and fundamental concept. Properties contributing to rheological behaviour. Graphical presentation of rheological data.

5. Rate and Order of Reactions

Kinetic Principles and Stability Testing, Theoretical Considerations Degradation, physical factors, influence of pH, temperature, ionic strength, acid base catalysis, UV light. Chemical factors. Complex chemical reactions, oxidation-reduction hydrolysis.

Books Recommended

1. Martin, P., Bustamante, P. and Chun, A.H.C. Physical and Chemical Principles of Pharmaceutical Science, 4th Edition; New York (1999).
2. Aulton M.E. Pharmaceuticals. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).
3. Rawlins E.A. (ed.) Bentley's Textbook of Pharmaceutics, 8th (or recent edition). Macmillan Publishing Co. Inc. New York (1977).
4. Banker G.S. and Rhodes C.T. Modern Pharmaceutics, 4th Edition (Revised and expanded), Marcel Dekker, Inc. New York (2002).
5. Carstensen J.T. and Rhodes C.T. (ed.) Drug Stability: Principles and Practices, 3rd edition (revised and expanded), Marcel Dekker, New York (2000).

Pharmaceutics - Physical Pharmacy (Lab)

PHT-502
Cr. Hrs. 3

Practical Elaborating Theory Course

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

Determination of emulsion systems. Practicals based on rheological and structural character of emulsions stabilized by mixed films of emulsifier.

Determination of particle size, angle of repose of powders. Preparation of buffer solutions and isotonic solution.

Determination of percentage composition of solutions by specific gravity method.

Partition-coefficient, surface tensions, viscosity.

Determination of various pH by acidic and alkaline buffers.

Drug stability experiments, preparation of stock solution (dilution method).

Determination of critical micelle concentration (CMC) of a surface-active agents. Flocculation and deflocculation of Kaolin Suspensions.

Books Recommended

1. Martin, P., Bustamante, P. and Chun, A.H.C. Physical and Chemical Principles of Pharmaceutical Science, 4th Edition, New York (1999).
2. Aulton M.E. Pharmaceuticals. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).

3. Rawlins E.A. (ed.) Berdley's Textbook of Pharmaceutics, 8th (or recent edition), Macmillan Publishing Co. Inc. New York (1977).
4. Banker G.S. and Rhodes C.T. Modern Pharmaceutics, 4th Edition (Revised and expanded), Marcel Dekker, Inc. New York (2002).
5. Carstensen J.T. and Rhodes C.T. (ed.) Drug Stability: Principles and Practices, 3rd edition (revised and expanded), Marcel Dekker, New York (2000).

Pharmaceutics - Industrial Pharmacy - I (Unit Operations)

PHT-504
Cr. Hrs. 3

1. **Mixing**

Fundamentals, mechanism. Mixing equipment used in liquid/liquid, liquid/solid and solid/solid mixing. Comminution (size reduction), Reasons for size reduction. Factors affecting size reduction, size analysis. Sieving, energy mills (Ball mill, edrunner, edge runner mill disintegrant, colloid mill, hammer mill, cutter mill, fluid energy mill etc.).

2. **Drying**

Theories of drying, drying of solids, classification of dryers, general methods, fluidized bed systems, pneumatic systems, spray dryer, freeze drying Clarification and Filtration Theory, filler media, filter aids, filter selection, equipment used for filtration.

3. **Evaporation**

General principles of evaporation, evaporators, evaporation under reduced pressure.

4. **Compression and Compaction**

The solid-air interface, angle of repose, flow rates, mass volume relationship, density, Heckel plots, consolidation, granulation, friability, compression (dry method, wet method, slugging), physics of tableting. Tableting machines and other equipment required, problems involved in tableting, tablet coating.

5. **Encapsulation**

Capsulation hard and soft gelatin capsules.

Books Recommended

1. Aulton M.E. Pharmaceutics. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).
2. Leon Lachman, Lea and Febiger. Theory and Practice of Industrial Pharmacy (1986).
3. James Swarbrick. Encyclopedia of Pharmaceutical Technology, Marcel and Dekker Publishing (2002).

Pharmaceutics - Biopharmaceutics & Pharmacokinetics

PHT-604
Cr. Hrs. 3

1. **Biopharmaceutics**

Definition and concept, bioavailability, physiology of the G.I.T. Physiologic factor affecting the physiochemical. Formulation factor. Dissolution, factor effecting the dissolution for the absorption of the drug. Physiology of the skin. Physiological factor effect the

absorption of the drug through the skin. Parenteral release dosage form. Route of administration, physiological factor effecting the absorption of the drug. Bio-pharmaceutics of other dosage form.

2. Pharmacokinetics

Review of mechanical fundamentals, rate and order of reaction. Definition and concept of pharmacokinetics. Determination through plasma level.

Books Recommended

1. Leon Shargel. Biopharmaceutics and Pharmacokinetics. Fourth Edition (2002).
2. Ronald D. Schoenwald. Pharmacokinetics Principles of Dosing Adjustment. (2002).
3. Milo Gibaldi. Biopharmaceutics and Clinical Pharmacokinetics. Fourth Edition (1991).

Pharmaceutics - Clinical Pharmacokinetics

PHT-606
Cr. Hrs. 3

1. **Compartment Models:**
One compartment model. Two compartment models. Three compartment models. Non-compartmental models.
2. **Biological Half-life in Vitamin.**
3. **Clearance, Elevation.**
4. **Protein Bounding.**
5. **Multiple dosage**
6. **Application of Pharmacokinetics in Clinical Situation.**
7. **Application in Dosage Sites.**
8. **Bioavailability and bioequivalence testing.**
9. **Pharmacokinetics of intravenous infusion.**

Books Recommended

1. Leon Shargel. Biopharmaceutics and Pharmacokinetics. Fourth Edition (2002).
2. Ronald D. Schoenwald. Pharmacokinetics Principles of Dosing Adjustment. (2002).
3. Milo Gibaldi. Biopharmaceutics and Clinical Pharmacokinetics. Fourth Edition (1991).
4. Bauer, L. 2008 Applied Clinical Pharmacokinetics, 2nd ed., McGraw-Hill, ISBN #0071476288.
5. Bonate, P.L. and Howard, D.R., ed. 2004 Pharmacokinetics in Drug Development: Regulatory and Development Paradigms, Volume 2, AAPS Press, Arlington, VA ISBN 0-9711767-3-6.
6. Boroujerdi. M. 2002 Pharmacokinetics: Principles and Applications, McGraw-Hill Professional Publishing, ISBN: 0-07135-164

Pharmaceutics - Pharmaceutical Technology (Lab)

PHT-614
Cr. Hrs. 3

- To prepare matrix tablet of drugs by single-punch machine**
 - Preparation of matrix tablet for less water soluble drug
 - Preparation of matrix tablet for highly water soluble drug
 - Perform dissolution testing by USP method I and II
- Formulation of 2 Model Drugs (highly soluble and less soluble) in Nano particles/Micro particles**
 - To prepare polymeric Nano/Micro particles by single / double emulsion / nanoprecipitation method(s)
 - Hydrophilic drugs by double emulsion method
 - Hydrophobic drugs by single emulsion method
 - Hydrophobic drugs by nanoprecipitation method
 - To visualize the nano/microparticles under stereomicroscope
 - To perform the release testing of 2 model drugs from nanoparticles stirring method (UV-visible spectroscopy)
- To prepare the oral formulation of drugs by extrusion/spheronization method**
 - Matrix based pellets
 - Coated pellets (perform coating)
 - Pelletization to form immediate release, controlled/extended release and enteric coated pellets.
- To observe the geometry and surface of spheronized formulation (pellets) by stereomicroscope**
- To perform the release testing of drugs from spheronized (pellets) particles by USP method I and II**
- To compare and study the swelling and disintegration profile (physical deformation) of expired vs. valid film, enteric coated tablets and hard gelatin capsules**

[the experiment involves the physical phenomena that happens to expired tablets specially the coating of polymers since they tend to be oxidized or cured over the period of time and may hamper the disintegration of tablets and capsules.
- To develop transdermal patches of suitable active pharmaceutical excipients.**
- To develop bilayer-tablet formulations of different active pharmaceutical ingredients.**
- Fast dispersible tablet formulations different NSAIDs.**
- To develop osmotically-controlled tablet formulations for control over extended period of time.**
- To preparation pharmaceutical hydrogels**
- To prepare liposomal formulations of 2 model drugs (highly soluble and low soluble)**

Books Recommended

- Aulton M.E. Pharmaceutics. The Science of Dosage Form Design. Harcourt Publishers. Second Edition (2002).
- Banker G.S. and Rhodes C.T. Modern Pharmaceutics, 4th Edition (Revised and expanded), Marcel Dekker, Inc. New York (2002).

Pharmaceutics - Prescription & Community Pharmacy

PHT-702
Cr. Hrs. 3

1. Basic Principles of Compounding and Dispensing

Weights and measures. Calculations for compounding and dispensing. Fundamental preparations in compounding. Containers and closures for different products. Prescription handling, Parts of prescription, filling, labelling, pricing of dispensed medication.

2. Extemporaneous Dispensing

3. **Pharmaceutical Incompatibilities**

Types of incompatibilities. Manifestations, correction and prevention with reference to typical examples.

4. **I. V. admixtures**

5. **Dispensing of radio pharmaceuticals**

6. **Definitions and background of community pharmacy**

7. **Epidemiology and its control. Prevents Health (EPI & CDC). Family planning. Health policy and national drug policy.**

8. **Patient assessment.**

9. **Medical compilation of drug administration (general & socio-economic aspects).**

10. **Patient pharmacist communication.**

11. **Patient education and counseling.**

12. **Control of drug abuse and misuse.**

13. **Role of pharmacist as public health educator in the community for drug monitoring and drug information**

Books Recommended

1. Carter SJ. Cooper and Guns. Dispensing for Pharmaceutical Students (1997).
2. Roy Robertson. Management of Drug Users in the Community: A practical Handbook edited.
3. Alfonso R Gennaro. Remington The Science and Practice of Pharmacy 20th Edition. Mack Publishing Company (2002).
4. Martindale's Extra Pharmacopoeia. 32nd edition. (2002).

Pharmaceutics - Pharmaceutical Management & Marketing

**PHT-704
Cr. Hrs. 3**

1. **Management**

Nature and principles of management, types and functions of managers.

2. **Planning**

Purpose and types of planning, steps in planning. Organizing, management control systems. Purpose, steps in the control process. Forms of operations control. Requirements for adequate control. Critical control points and standards. Motivation, innovation and creativity, communication.

3. **Production Management**

Material management, supply chain, demand management, regulatory control.

4. **Marketing Management**

Marketing channels, promotion, advertising and salesmanship. Promotion marketing.

5. **Sales Management**

Personnel, buying, receiving and pricing, Sales promotion and customer services.

6. **Pharmacy Layout Design**

Objectives of layout design. Types of community pharmacies. Pharmaceutical centre, prescription-oriented pharmacies, traditional pharmacies, the super drug store. Consumer goods and purchases. Classes of layout designs. Principles and characteristics of layout design. Traffic flow analysis.

Books Recommended

1. Patrick Tharp C. and Pedro J. Lecca. Pharmacy Management for students and practitioners.
2. Harry A. Smith. Principles and Methods of Pharmacy Management.
3. Dalton E. McFarland. Management – Foundations and Practices.
4. Kreitner. Management.
5. Newman and Summer. The Process of Management.

Pharmaceutics - Prescription Pharmacy (Lab)

PHT-706
Cr. Hrs. 3

Practicals Elaborating Theory Course

Preparation and dispensing of:

Syrups, mixtures, ointments, creams, lotions, pastes, ear drops, glycerite, mouth wash, nasal drops etc.

Books Recommended

1. Carter S.J. Cooper and Guns. Dispensing for Pharmaceutical Students (1997).
2. Roy Robertson. Management of Drug Users in the Community: A practical Handbook edited.
3. Alfonso R Gennaro. Remington The Science and Practice of Pharmacy 20th Edition. Mack Publishing Company (2002).
4. Martindale's Extra Pharmacopoeia. 32nd edition. (2002).

Pharmaceutics - Quality Control and Quality Assurance

PHT-708
Cr. Hrs. 3

1. Validation of Pharmaceutical Process

Control of components and drug product containers and doses. Production and process controls. Packaging and labelling controls. Holding and distribution. Repackaging and relabelling. Regulating basis for person validation, sterilization validation of sterile products. Sterile product validation. Validation of solid dosage form. Process validation and quality assurance. Prospective process validation, validation for water system for sterile and non-sterile products, cleaning validation, equipment validation, process validation of raw materials. Analytical method validation, computer system validation, validation of diluted aerosole.

2. Different Quality Control tests:

of liquids, emulsion, solid state and time-release product. Biological assays. Biological methods. Bioassay of antibiotics. Standard preparation and unit of activity. Assay of vitamins, hormones miscellaneous tests. Toxicity tests and identification test, ash contents etc. General knowledge of B.P, B.P.C. USP, N. etc. Statistical interpretation of quality controls data. Quality control and assurance of hospital and clinical pharmacy.

Books Recommended

1. Sydney H. Willig. Good Manufacturing Practices for Pharmaceuticals. Marcel Dekker Publishing.
2. Pharmaceutical Process Validation. Marcel Dekker Publishing (1999)
3. Joseph. T. Dipiro. Encyclopedia of Pharmaceutical Technology. Marcel Dekker Publishing (2003).

Pharm. D. (Deficiency) Courses

1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHT -513 (D)	Computer Application in Pharmacy	2	PHT-606 (D)	Clinical Pharmacokinetics	3
PHT -613 (D)	Pharmaceutical Technology	3	PHT-614 (D)	Pharmaceutical Technology (Lab)	3
			PHT-702 (D)	Clinical Pharmacy	3
			PHT-708 (D)	Pharmaceutical Quality Control and Assurance	2
Total 6 courses, making 16 Credit hours in one year.					

First Semester

Computer Application in Pharmacy (Practical)

PHT-513(D)
Cr. Hrs. 2

- 1. Introduction to Microsoft Windows and its Different Packages Like MS Word, Excel, PowerPoint and Access**
- 2. Internet and Email**

Internet and microsoft internet explorer 5, searching the internet E-mail and News group. Favourites, security and customizing explorer.
- 3. Web Page Development**

Introduction to frontpage, creating a first Website, basic formatting technique, manipulating tables within frontpage, frontpage, pictures and multimedia, hyperlinking, bookmarks and image maps, Frontpage and frames. Managing your web, good site design
- 4. Complete Statistical Packages, Statistica**
- 5. Languages, at Least Two Prevailing Languages Will be Taught**

Books Recommended

1. Introduction to computers
2. Windows XP 2004,
3. Teach Yourself Visually MS Word® Lisa A. Bucki. 2007
4. Teach Yourself Visually MS Power Point® Lisa A. Bucki. 2007
5. Teach Yourself Visually MS Excel® Lisa A. Bucki. 2007

Pharmaceutical Technology

PHT-613(D)
Cr. Hrs. 3

- 1. Principles of Pharmaceutical Formulation and Dosage Form Design, Product formulation, need for dosage form, preformulation studies.**
- 2. Formulation Development**

Pharmaceutical aerosols, ophthalmic preparations, 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. 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. Production of biotech compounds, biotech vaccines, dispensing of biotech compounds.

5. Novel Drug Delivery Systems

Introduction to the drug carrier, liposomes as a drug carrier, niosomes as a drug carrier, biodegradable polymers as a drug carrier, active and passive drug delivery system, other novel GIT systems, novel topical drug delivery systems.

6. 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, instrumentation in granule manufacturing.

Books Recommended

1. Novel Drug Delivery System, Yie W. Chein. Marcel Dekker Publishing 2004.
2. Pharmaceutical Biotechnology, Daan J. Crommelin, 2002.
3. Modern Pharmaceutics, Gilbert S. Banker. Marcel Dekker Publishing (2002).

Second Semester

Clinical Pharmacokinetics

PHT-606(D)
Cr. Hrs. 3

1. Compartment Models:

One compartment model. Two compartment models. Three compartment models. Non-compartmental models.

2. Biological Half-Life in Vitamin

3. Clearance, Evaluation

4. Protein Binding

5. Multiple Dosing Regimens

6. Application of Pharmacokinetics in Clinical Situation

7. Application in Dosage Sites

8. Bioavailability and Bioequivalence Testing

9. Pharmacokinetics of Intravenous Infusion

10. Non-Linear Pharmacokinetics

Books Recommended

1. Biopharmaceutics and Pharmacokinetics, Leon Shargel. Fourth Edition (2002).
2. Pharmacokinetics Principles of Dosing Adjustment, Ronald D. Schoenwald. (2000).
3. Biopharmaceutics and Clinical Pharmacokinetics, Miol Gibaldi. Fourth edition (1991).

Pharmaceutical Technology (Practical)

PHT-614(D)
Cr. Hrs. 3

1. Blood sampling techniques in laboratory animals like dog, rabbits, mice etc. in human-beings.
2. Plasma level time curve determination of pharmacokinetic parameters
3. In-vitro dissolution studies
4. Optional dose determination.
5. Measurement of rate of bioavailability.
6. Determination of plasma protein binding.
7. Determination of relative and absolute bioavailability.
8. Urinary sampling techniques.
9. In laboratory animals. In humans, renal excretion of drugs or drug disposition.

10. Various techniques to develop the controlled release formulation
11. Biotechnological aspects of product development
12. Coating of particles
13. To prepare, examine and control specifications of packaging materials

Books Recommended

1. Drug delivery and targeting, Anya M. Hellery.
2. Controlled drug delivery, Joseph R. Robinson.
3. Pharmaceutical design and development, Ramabhadran T.V.
4. Modern Pharmaceutics, Gilbert S. Banker. Marcel Dekker Publishing (2002).
5. Pharmaceutical Biotechnology, Daan J. Crommelin, 2002
6. Jain N.K. Controlled and Novel drug delivery.

Clinical Pharmacy

PHT-702(D)
Cr. Hrs. 3

1. Rational Use of Drugs
2. Rational prescribing, rational dispensing, problems of irrational drug use, learning about drug use problem, sampling to study drug use, indicators of drug use.
3. Introduction to Essential Drugs
4. Criteria for selection, use, advantages.
5. Drug Utilization evaluation & Drug Utilization Review (DUE/PUR)
6. Development of protocol of use of low very low therapeutic index drugs (Steroids, Vancomycin, Cimetidine etc).
7. Drug abuse and misuse. Drug induced modification of lab test values and drug induced diseases.
8. Practical Pharmacokinetics
9. Therapeutic drug monitoring of the narrow therapeutic range drugs and other essential drugs.
10. Pharmacoeconomic studies
11. Pharmaceutical care its scope, management and application of care plan.
12. Role of clinical pharmacist in community pharmacy.
13. Safe intravenous therapy and hazards of intravenous therapy
14. Non-compliance: Definition, introduction and importance. Extent of non-compliance. Methods of assessment. Reasons for non-compliance. Strategies for improving compliance.
15. Designing of compliance trials.
16. Patient Counseling
17. Patient Profile: Patient disease profile, taking case history, drug profile of 25 drugs.
18. Adrenaline, aminoglycosides, anti TB drugs, antiepileptics, atropine, benzodiazepines, cephalosporins, chlorpheniramine, cimetidine, digoxin, dobutamine, dopamine, fluroquinolone, frusemide, lactulose, macrolides, metoclopramide, morphine/pethidine, nifedipine, NSAIDS. ORS, penicillins, prednisolone, salbutamol, vancomycin,
19. Utilization of clinical drug literature: Introduction. Drug literature selection. Drug literature evaluation. Drug literature communication withdrawal, detection, reporting and management of ADR.
20. Computers in clinical pharmacy:
21. Role of Pharmacist in clinical trials of drug substances.
22. Designing of clinical trials. Types or trials. Choice of patients. Exclusion of patients. Monitoring a clinical trial.

23. Drug Interactions and Adverse Drug Reactions
24. Drug Interactions: Mechanism, physiological factors affecting interaction. Types and level of drug interactions. Role of pharmacist in evaluating drug interactions and its management.
25. Adverse drug reactions and side effects: Classification, Excessive pharmacological response. Idiosyncrasy, secondary pharmacological effects. Allergic drug reactions, General toxicity, toxicity following drug.

Books Recommended

1. Encyclopedia of Pharmacy, Joseph. T. Dipiro.. Marcel Dekker Publishing (2002).
2. Pharmacist Talking with Patients, Mellainie. J. Rantucci. (1997).
3. Remington Science and Practice of Pharmacy. 20th Edition (2002).
4. Pharmaceutical Practice, Aulton. M.E. Prentice Hall Publishing 2000.

Pharmaceutical Technology (Practical)

PHT-708(D)
Cr. Hrs. 2

1. Good Manufacturing Practices for Pharmaceuticals

Control of components and drug product containers and doses. Production and process controls. Packaging and labelling controls. Holding and distribution. Repackaging and relabelling.

2. Validation of Pharmaceutical Process

Regulating basis for person validation, sterilization validation of sterile products. Sterile product validation. Validation of solid dosage form., Process validation and quality assurance. Prospective process validation, validation for water system for sterile and non-sterile products, cleaning validation, equipment validation, process validation of raw materials. Analytical method validation, computer system validation, validation of diluted aerosole

3. Different tests of liquids, emulsion, Solid state and Time Release Product

Biological assays, biological methods, bioassay of antibiotics. Standard preparation and unit of activity. Assay of vitamins, hormones.

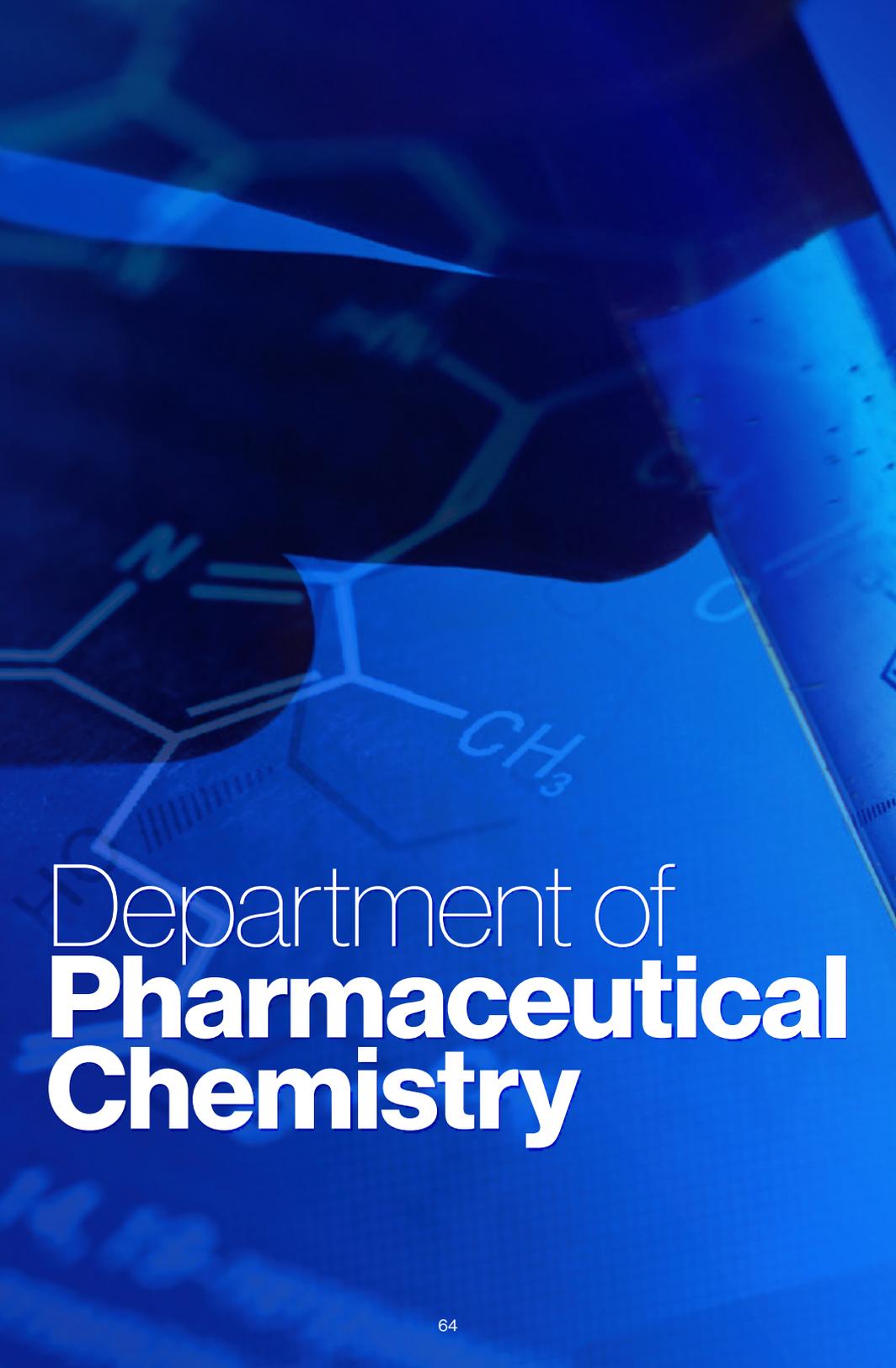
4. Miscellaneous Tests

Toxicity tests and identification test, ash contents etc. general knowledge of B.P, B.P.C. USP, N. etc. Statistical interpretation of quality controls data, quality control and 5.5.

5. Quality Assurance of Hospital and Clinical Pharmacy

Books Recommended

1. Good Manufacturing Practices for Pharmaceuticals, Sydney H. Willig. Marcel Dekker Publishing 2000
2. Pharmaceutical Process Validation. Marcel Dekker Publishing 2005.
3. Encyclopedia of Clinical Pharmacy, Joseph. T. Dipiro. Marcel Dekker Publishing (2003).



Department of
**Pharmaceutical
Chemistry**

The Department of Pharmaceutical Chemistry was established in 1973 as independent unit of the Faculty of Pharmacy and since then performing its dynamic and active role in pharmacy education and research. The department offers Pharm. D., M. Phil. and Ph. D. courses. The undergraduate program of the department is dedicated to educate and train the students to produce active, skilled and responsible future pharmacist for academia, industry, hospitals and government and other health care setups. Courses offered by the department are based on organic, physical, analytical, instrumental and medicinal chemistry revolving around drug discovery and development. The curriculum also focuses on laboratory experience supported by an excellent teaching and infrastructure. Department comprised of two separate large buildings having spacious classrooms and well-equipped lab facilities.

The department currently boasts a dedicated faculty comprising seven professors and three assistant professors, all actively engaged in both teaching and research. Over the past five decades, the department has been privileged to have numerous eminent

and senior professors, including four, who have served as Dean of the Faculty. It is a great honor that distinguished scientists and scholars such as Prof. Dr. Z.S. Saify (former Dean, Faculty of Pharmacy, and Vice Chancellor, University of Karachi) and Prof. Dr. Iqbal Ahmed (Sitara-e-Imtiaz) have been associated with the department, contributing over fifty years of invaluable service

The department has a rich history of excellence in research and until now more than two hundred M. Pharm., M. Phil., and Ph.D. research scholars have been produced. Additionally, several hundred research papers have been published in renowned academic journals. The department offers dynamic and diverse research disciplines, including the synthesis of biologically active lead molecules, computer-aided drug design, photochemistry, natural product chemistry, stability testing, method development, and the medical applications of nanotechnology (nanomedicines).

The department not only believes but also striving to provide standard education to improve knowledge and skills with professional and personal grooming of the future Pharmacists.

Faculty

Pharmaceutical Chemistry



Dr. Faiyaz H. M. Vaid

Professor and Dean (2023)
Chairman (2024)

Qualification

Ph.D., M. Pharm., B. Pharm.
(University of Karachi)

Year of Association

2002

Subjects of Interest

**Physical Chemistry, Analytical Chemistry,
Quality Control and Quality Assurance**

Area of Research Interest

**Stability of Pharmaceuticals, Method
Development, Drug Development,
Formulation**

Email

faiyazvoid@gmail.com

Phone Number

(+92-21) 99261300-7 Ext 2203, 3203



Dr. Mansoor Ahmed

Professor

Qualification

Ph.D., M.Sc.
(University of Karachi)

B.Sc. (D.J. Science College)

Year of Association

2002

Subjects of Interest

Organic Chemistry

Area of Research Interest

Organic Synthesis

Email

cando@cyber.net.pk

Phone Number

(+92-21) 99261300-7 Ext 2203



Dr. Afaq Ahmed Siddiqui

Professor

Qualification

Ph.D., M.Sc., B.Sc.
(University of Karachi)

Year of Association

1996

Subjects of Interest

**Biostatistics (Applied Statistics),
Mathematics**

Area of Research Interest

Applied Statistics

Email

siddiquiaaspak@yahoo.com

asiddiqui@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext 2203

Faculty

Pharmaceutical Chemistry



**Dr. Nousheen
Mushtaq**

Professor

Qualification

**Ph.D., M.Phil., B. Pharm.
(University of Karachi)**

Year of Association

2002

Subjects of Interest

Medicinal Chemistry, Analytical Chemistry

Area of Research Interest

**Computer Aided Drug Design (targeted
synthesis of biologically active compounds)**

Email

nmushtaq@uok.edu.pk

noshin_mushtaq@yahoo.com

Phone Number

(+92-21) 99261300-7 Ext 2203



**Dr. Sohail
Hassan**

Professor and Chairperson (2023)

Qualification

**Ph.D., M.Phil., B. Pharm.
(University of Karachi)**

Year of Association

2006

Subjects of Interest

**Physical Chemistry, Analytical Chemistry,
Medicinal Chemistry**

Area of Research Interest

**Method Development, Stability Studies, Drug
Interaction**

Email

shassan@uok.edu.pk

pharmagemst@gmail.com

Phone Number

(+92-21) 99261300-7 Ext 2203



Dr. Asia Naz

Professor

Qualification

**Ph.D., B. Pharm.
(University of Karachi)**

Year of Association

2012

Subjects of Interest

Pharmaceutical Chemistry, Nanomedicine

Area of Research Interest

Analytical Chemistry

Email

asia.naz@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext 2203

Faculty

Pharmaceutical Chemistry



Dr. Safila Naveed

Professor

Qualification

**Ph.D., M.Phil., B. Pharm.
(University of Karachi)**

Year of Association
2023

Subjects of Interest

Pharmaceutical Sciences: Medicinal Chemistry, Physical Chemistry, Analytical Chemistry

Area of Research Interest

Drug Designing, Organic Synthesis, Formulation Development, Clinical Pharmacokinetics

Email

safila.sharif@uok.edu.pk

safila117@gmail.com

Phone Number

(+92-21) 99261300-7 Ext 2203



Dr. Shazia Haider

Assistant Professor

Qualification

**Ph. D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association
2012

Subjects of Interest

Pharmaceutical Chemistry

Area of Research Interest

Organic Synthesis, Drug Design, Nanomedicine

Email

shazia.haider@uok.edu.pk

shazonadir2003@yahoo.com

Phone Number

(+92-21) 99261300-7 Ext 2203



Dr. Rubina Siddiqui

Assistant Professor

Qualification

**Ph. D, M. Phil., B. Pharm.
(University of Karachi)**

Year of Association
2012

Subjects of Interest

Analytical Chemistry, Medicinal Chemistry

Area of Research Interest

Interaction Studies, Derivative Preparation

Email

rsiddiqui@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext 2203

Faculty



Dr. Urooj Nazim

Assistant Professor

Qualification

Ph. D., (University of Karachi)

M. Phil., Pharm. D. (Baqai Medical University)

Year of Association

2012

Subjects of Interest

Organic Chemistry, Medicinal Chemistry

Area of Research Interest

Stability Studies, Drug Interaction Studies

Email

urooj.nazim@uok.edu.pk

urooj.nazim@yahoo.com

Phone Number

(+92-21) 99261300-7 Ext 2203

Pharmaceutical Chemistry

Board of Studies

Dr. Sohail Hassan

Professor and Chairperson

Dr. Faiyaz H. M. Vaid

Professor and Dean

Dr. Mansoor Ahmed

Professor

Dr. Afaq Ahmed Siddiqui

Professor

Dr. Nousheen Mushtaq

Professor

Dr. Asia Naz

Professor

Dr. Safila Naveed

Professor

Dr. Rubina Siddiqi

Assistant Professor

Ms. Urooj Nazim

Assistant Professor

Prof. Dr. Shamim Akhtar

Dean, Faculty of Pharmacy
Hamdard University, Karachi

Dr. Fahim Ahmed Siddiqui

General Manager Plant Production
Bosch Pharmaceutical (Pvt.) Ltd.,
Karachi

Dr. Arfa Akram

Chairperson, Department of Pharmaceutical Chemistry
Federal Urdu University of Arts, Sciences and Technology

Dr. Wajiha Gul

Assistant Professor
Department of Pharmaceutical Chemistry
DOW University of Health Sciences, Karachi

Pharm. D. Courses

First Professional					
1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHC - 303	Organic Chemistry	3	PHC - 304	Organic Chemistry (Practical)	3
PHC - 313	Pharmaceutical Mathematics	3	PHC - 306	Pharmaceutical Statistics	3
			-	-	-
Second Professional					
PHC - 405	Physical Chemistry - I	3	PHC - 406	Physical Chemistry - I (Practical)	2
-	-	-	PHC - 408	Physical Chemistry - II	3
Third Professional					
PHC - 503	Physical Chemistry - II (Practical)	3	PHC - 506	Preparation And Quality Control (Practical)	3
PHC - 505	Theoretical Basis of Quality Control	3	PHC - 508	Pharmaceutical Analysis - I	3
Fourth Professional					
PHC - 607	Pharmaceutical Analysis - I (Practical)	3	PHC - 608	Pharmaceutical Analysis - II	3
-	-	-	PHC - 610	Medicinal Chemistry - I	3
Fifth Professional					
PHC - 707	Pharmaceutical Analysis - II (Practical)	3	PHC - 710	Medicinal Chemistry - III	3
PHC - 709	Medicinal Chemistry - II	3	-	-	-
Total 17 Courses making 50 Credit Hours in five years.					

First Semester First Professional

Organic Chemistry

PHC-303
Cr. Hrs. 3

1. Introduction to pharmaceutical chemistry, classification and nomenclature of organic pharmaceutical compounds. hyperconjugation, steric effects, inductive effect and mesomeric effect.
2. Nucleophilic and electrophilic substitution reaction in aromatic system. Theory of resonance.
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.
5. Carbonium ion rearrangements; Pinacol-pinacolone, Wagner-Merrwein, Wolf, Hofmann and Beckmann rearrangements.
6. Carbanions; condensation reaction (Aldol condensation; Favorskii rearrangement; Wittig reaction).
7. Stereoisomerism, optical isomerism, geometrical isomerism, tautomerism of carbonyl compounds, resolution of racemic mixture and conformational analysis.
8. Free radicals: Introduction, structure and stability.
9. General methods of preparations, properties, identification test and pharmaceutical applications of the following classes and their analogs:
10. alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, esters, amines and aniline.

Books Recommended

1. A Guide Book to Mechanisms in Organic Chemistry Peter Sykes. Fourth edition, Longman Group Ltd. (1978).
2. Introduction to Organic Chemistry by William H. Brown Saunders College Publishing 3rd edition (2002).
3. Organic Chemistry Graham Solomons T.W. Fifth edition, John Wiley & Sons, Inc. (1992).
4. Textbook of Organic Medicinal and Pharmaceutical Chemistry Wilson and Gisvold's. 10th edition, Lippincott-Raven Publisher (1998).
5. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Pnen, Inc., USA (1992).

Pharmaceutical Mathematics

PHC-313
Cr. Hrs. 3

1. **Algebra**
Common and natural logarithm, solution of linear and quadratic equations. Equations reducible to quadratic form, solution of simultaneous equations. Arithmetic. Geometric and harmonic progressions. Arithmetic, geometric and harmonic means, permutations and combinations. Binomial Theorem: Simple application.
2. **Trigonometry**
Measurement of angles in radian and degrees. Definitions of circular functions. Derivation of circular function for simple cases and trigonometry identities.
3. **Analytical Geometry**
Coordinates of point in a plane. Distance between two points in a plane. Locus. Equations of straight parallel and perpendicular lines. Equation of parabola, circle and ellipse.

4. **Differential Calculus**

Limit, concept of derivative. Rules of differentiation, examples on the evaluation of derivatives. Derivatives of algebraic, trigonometric, exponential and logarithmic functions, partial differentiation, higher order derivatives. Maxima and minima points of inflections.

5. **Integral Calculus**

Concept of integration. Rules of integration. Integrations of algebraic, exponential, logarithmic and trigonometric functions by using different techniques and numerical integration.

Books Recommended

1. Edvards, C.H. Jr. and David E. Penney, Calculus and Analytical Geometry (1995).
2. Text Book of Algebra and Trigonometry for Class XI and XII (New edition).

Second Professional

Physical Chemistry I

PHC-405
Cr. Hrs. 3

1. **Physical Properties and Molecular Constitution**

Surface and interfacial tension, dielectric constant, dipole moment, refractive index, optical rotation, density, specific gravity, viscosity, molar refraction, parachor.

2. **Colloids and Colloidal System**

Characteristics features of colloids, type of colloidal system, properties of colloids and colloidal systems. Preparation and purification of colloidal solutions, stability of colloids, pharmaceutical applications.

3. **Solutions**

Definition types and properties, concentration, solubility and solubilization, factors affecting solubility, solvents used in pharmacy, solutions of electrolytes and non-electrolytes, isotonic solutions, dissolution and dissolution rates, distribution phenomena, theory of distillation, molecular weight determination.

4. **Ionic Equilibria**

Modern theory of acids, bases and salts, acid-base equilibria, pH and acidity constants, theory of indicators, buffers and buffered system.

5. **Phase Equilibria**

Phase rule and its applications to one and two component system.

Books Recommended

1. British Pharmacopoeia, Stationary Press, Royal Society of Pharmaceutical Press, London (2005).
2. Physical Pharmacy Martir A.N., 4th Edition, Lea and Febiger, Philadelphia (1993).
3. Practical Pharmaceutical Chemistry Backet and Stenlake., Royal Press, London (1998).
4. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Eston, Pennsylvania, USA.
5. United State Pharmacopoeia, United State pharmacopeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008.

Third Professional

Physical Chemistry II (Practical)

PHC-503
Cr. Hrs. 3

1. Conductometric determination of the ionization constant of a weak acid.
2. Conductometric determination of the solubility of sparingly soluble salt.
3. U. V. absorption spectra of aromatic compounds and geometric isomers.
4. Determination of the wavelength of maximum absorbance and molar extinction coefficient of a given sample.
5. Determination of the first-order rate constant for acid catalyzed hydrolysis of a given sample.
6. Determination of the first-order rate constant for the decomposition of a given sample.
7. Determination of effect of change of temperature in the rate of reaction.
8. To study the stability of a drug subjected to various stress conditions
9. Determination of heat of neutralization of HCl and NaOH.
10. Determination of heat of vapourization / transition of a given sample.
11. Determination of heat of solution from solubility.
12. Determination of an equilibrium constant by distribution method.

Books Recommended

1. Pharmaceutical Analysis, Higuchi T. and BrochmannHanssen E., Interscience, New York.
2. Physical Chemistry Barrow G.M... McGraw-Hill, London (1973).
3. Physical chemistry by Fazal I Hussain, 3rd Edition (1991).
4. Physical Chemistry, Barrow G.M... McGraw-Hill, London (1973).
5. Text Book of Physical Chemistry by Sameul Glasstone, 2nd Edition MCMillan & Company Ltd. (1946).

Theoretical Basis of Quality Control

PHC-505
Cr. Hrs. 3

1. Pharmaceutical chemistry and its relation to other sciences.
2. Brief historical outline.
3. Raw material for drugs
4. Sources of impurities in pharmaceuticals.
5. Purity and its control.
6. Testing and determination of water.
7. Survey of analytical methods
8. Quantitative and qualitative analysis (general information)
9. Pharmacopeial tests and specifications.
10. Standardization of pharmaceuticals and formulated products.
11. Quality control system for drugs and pharmaceuticals
12. Causes of poor quality and general requirements.
13. Total quality management, a new approach.
14. Sampling techniques, validation and statistical treatment of analytical data.

Books Recommended

1. Pharmaceutical Analysis – A Textbook of Pharmacy, Student and Pharmaceutical Chemistry Watson D.G. Churchill Livingston (1999).
2. Quantitative Analysis, Theory and Practice by Lawrence W. Pott Harper and raw Publisher New York (1987).

3. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Eston, Pennsylvania, USA.
4. United State Pharmacopoeia, United State pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London. 6th Edition (2006).

Fourth Professional

Pharmaceutical Analysis – I (Practical)

PHC-607
Cr. Hrs. 3

1. **Assay of pharmaceutical compounds based on chemical methods**
Acid base titration, oxidation-reduction titration, complexometric titration, gravimetric, solvent extraction, and gasometric methods.
Potentiometric determination.
pH of a solution and titration of an acid.
Strength of unknown solution of HCl with NaOH.
Strength of each acid in a mixture of HCl and CH₃COOH using standard alkali.
Conductometric determination.
Equivalent point of titration of HCl with NaOH.
2. **Polarographic determination**
Amount of nitrobenzene in solutions.
Quinhydrone.
3. **Determination of refractive index of liquids by Abbe-refractometer.**
Determination of the composition of unknown mixture of two liquids.
Determination of the concentration of alcohol in solutions.
Determination of a 10% solution of calcium chloride.
4. **Polarimetric determination of:**
Concentration of sugar in a given solution.
Percentage of two optically active substances in a given solution.
5. **Fluorometric determination of a standard drug in a given sample.**

Books Recommended

1. British Pharmacopoeia, Stationary Press, Royal Society of Pharmaceutical Press, London
2. United State Pharmacopoeia, United State Pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008
3. Practical Pharmaceutical Chemistry Backet and Stenlake., Royal Press, London (1998).
4. Quantitative Analysis, Theory and Practice by Lawrence W. Pott Harper and raw Publisher New York (1987).
5. Vogel's Textbook of Quantitative Inorganic Analysis including Elementary Instrumental Analysis, Longman, 6th Edition, London (2006).

Fifth Professional

Pharmaceutical Analysis – II (Practical)

PHC-707
Cr. Hrs. 3

1. Assay of pharmaceutical compounds based on spectrophotometric methods.
2. Separation, identification and quantitation of a drug substance by chromatographic methods such as TLC, GLC, HPLC.
3. To study the methods development procedure of a drug substance by UV-Visible spectroscopy/TLC/GLC/HPLC.
4. To study the experimental methodology of validation of a drug substance by UV-Visible spectroscopy/TLC/GLC/HPLC.

Books Recommended

1. British Pharmacopoeia, Stationary Press, Royal Society of Pharmaceutical Press, London (2005).
2. Instrumental Methods of Chemical Analysis by Golden W. Evings, McGraw Hill London 5th Edition (1985).
3. Principle of Instrumental Analysis, Skoog Holter and Nieman 5th Edition (2000).
4. United State Pharmacopoeia, United State pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London. 6th Edition (2006).

Medicinal Chemistry-II

PHC-709
Cr. Hrs. 3

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

- 1. Analgesic and Antipyretics**
Paracetamol, salicylic acid analogues, quinolines derivatives pyrazolone and pyrazolidines, N-aryl anthranilic acids, aryl and heteroaryl acetic acid derivatives.
- 2. Local Anesthetics**
Benzoic acid derivatives, lidocaine derivatives (anilids), amino benzoic acid, miscellaneous compounds such as: Procaine, lignocaine, eucaine, cocaine and benzocaine.
- 3. Central Nervous System Depressants**
General anesthetics, inhalation anesthetics, ultrashort acting barbiturates, dissociative anesthetics such as cyclopropane, halothane, nitrous oxide, chloroform, thiopental sodium, ketamine, methohexital, thiamylal sodium, fentanyl citrate, tribromo ethanol.
Anxiolytics, sedative, hypnotics, such as benzodiazepines, barbiturates, paraldehyde, glutethimide, chloral hydrate and alcohols.
Anti-convulsant such as barbiturates, hydantoins, oxazolidinediones, succinimides, benzodiazepines.
Antipsychotics, such as phenothiazines, fluor butyrophenones, -aminoketones, CNS depressants with skeletal muscle relaxant properties.
- 4. Central Nervous System Stimulants**
Tricyclic antidepressants, monoamine oxidase inhibitors, analeptics, picrotoxin, methylxanthines, Indole ethyl amines, 2-phenylethylamines.
- 5. Diuretics**
Site-1, site-2, site-3 and site 4 diuretics, like acetazolamide, high ceiling or loop diuretics, potassium sparing diuretics, mercaptopmerin, meralluride, ethacrynic acid, thiazide and thiazide like diuretics, spironolactone, triamterene etc.

6. **Antiviral agents such as acyclovir, tromantadine hydrochloride, ribavirin**
7. **Immunosuppressive agents such as azathioprine, cyclosporine**
8. **Anti-Neoplastic Agents**
Alkylating agents, antimetabolites, antibiotics, plant products, miscellaneous compounds, hormones, immunotherapy, such as methotrexate, 5-fluorouracil, actinomycins, anthracyclines, vincristine, tamoxifen.
9. **Anti-Histamines**
H1-antagonists, H2-antagonists, aminoalkyl ethers, ethylenediamines, propylamine derivatives, phenothiazine derivatives, piperazine derivatives, such as diphenhydramine, pyrilamine, promethazine, cyclizine, terfenadine, cimetidine, ranitidine.

Books Recommended

1. Principles of Medicinal Chemistry, William O. Foye, Thomas L. Lemke and David A. Williams, Wolters Kluwer, Lippincott Williams & Wilkins 7th edition, (2013).
2. Textbook of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvold's. 12th edition, Wolters Kluwer, Lippincott Williams & Wilkins (2011).
3. Introduction to Medicinal Chemistry: How Drugs Act and Why, Alex. Gringuaz, John Wiley & Sons Inc. (1997).
4. Burger's Medicinal Chemistry and Drug Discovery edited by E. Wolf, 6th edition, Wiley-Inter Science, New York (2003).
5. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Pnen, Inc., USA (1992).

Second Semester First Professional

Organic and Inorganic Chemistry (Practical)

PHC-304
Cr. Hrs. 3

1. Identification of unknown simple organic compounds containing acidic, basic and neutral functional groups.
2. Estimation of functional groups in the following drugs:
Sulfa drugs, aspirin, paracetamol, benzyl penicillin, bromisoval, methenamine.
4. Determination of iodine and saponification value, and ash content.
5. Preparation of some organic and inorganic compounds:
Acetanilide, iodoform, nitrophenol, 3-nitrophthalic acid, benzhydryl, 2, 4-dinitro-chlorbenzene, ferrous sulfate, aluminum hydroxide, magnesium carbonate, sodium carbonate.

Books Recommended

1. A Guide Book to Mechanisms in Organic Chemistry Peter Sykes. Fourth edition, Longman Group Ltd. (1978).
2. Pharmaceutical Analysis – A Textbook of Pharmacy, Student and Pharmaceutical Chemistry Watson D.G., Churchill Livingstone (1999).
3. Introduction to Organic Chemistry by William H. Brown Saunders College Publishing 3rd edition (2002).
4. Organic Chemistry Graham Solomons T.W. Fifth edition, John Wiley & Sons, Inc. (1992).
5. Practical Pharmaceutical Chemistry Backet and Stenlake, Royal Press, London (1998).

Pharmaceutical Statistics

PHC-306
Cr. Hrs. 3

1. What is statistics? Importance's of statistics. What is biostatistics? Application of statistics in biological and pharmaceutical sciences. How samples are selected.
2. Organizing and displaying data: Variables, quantitative and qualitative variables, univariate data, bivariate data. frequency table, diagrams, pictograms, simple bar charts, multiple bar charts, histograms.
3. Summarizing data and variation: The mean, the median, the mode, the variance and standard deviation, coefficient of variation and skewness.
4. Probability: Definitions of probability, rules of probability. Distributions (binomial, poisson, and normal probability distributions).
5. Test of hypothesis and significance: Statistical hypothesis, level of significance, test of significance. Confidence intervals. Test involving binomial and normal distributions. Student "t" and Chi-square distribution test of significance based on "t" and chi square distributions.
6. Curve Fitting: Fitting a straight line, fitting of parabolic or high degree curve.
7. Regression and correlation: simple linear regression model. Correlation co-efficient.
8. Analysis of variance: One-way classification, partitioning of sum of squares and degrees of freedom. Multiple comparison tests such as LSD. The analysis of variance models

Books Recommended

1. Beth Dawson-Saunders. Basic and Clinical Biostatistics, 3rd Edition, A Lange Medical Book. London.
2. Biostatistics, A Foundation Analysis in the Health Sciences, Daniel, W.W., 4th edition Bernard Rosner (1987).
3. Fundamentals of Biostatistics, 4th Edition Wadsworth Publishing Company, USA (1995).
4. Introduction to Statistics, Ronald Walpole, 3rd edition (1990).
5. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Easton, Pennsylvania, USA.

Second Professional

Physical Chemistry – I (Practical)

PHC-406
Cr. Hrs. 2

1. Determination of specific gravity of liquids/syrups using an Ostwald pycnometer.
2. Determination of the viscosity of a liquid by Ostwald viscometer.
3. Determination of the percent composition of a mixture of ethanol and water by viscometry method.
4. Determination of the parachor value of an organic liquid.
5. Determination of the surface tension of a pure liquid by the drop count method.
6. Determination of the percentage composition of mixture of ethanol and water by surface tension method.
7. Determination of interfacial tension between benzene and water by the drop count method.
8. Determination of solubility of benzoic acid over a range of temperatures and calculation of its heat of solution.
9. Determination of the mutual solubility curve of phenol and water.
10. Preparation of buffer solutions and measurement of pH.
11. Determination of variation of miscibility with temperature.
12. Determination of the partition coefficient of I₂ between CCl₄ and H₂O.

Books Recommended

1. Pharmaceutical Analysis, Higuchi T. and Brochmann Hanssen E., Inter-science, New York.
2. Physical Chemistry Barrow G.M., McGraw-Hill, London (1973).
3. Physical Chemistry by Fazal I Hussain, 3rd Edition (1991).
4. Physical Chemistry, Barrow G.M., McGraw-Hill, London (1973).
5. Textbook of Physical Chemistry by Sameul Glasstone 2nd Edition MC Millan & Company Ltd. (1946).

Physical Chemistry – II

PHC-408
Cr. Hrs. 3

1. Electrochemistry

Definition, resistance, conductance, specific conductance, conductivity and its measurement, conductometric titrations, electrochemical cells, determination of pH and redox potentials, electrophoresis and electro dialysis.

2. Photochemistry

Definition light absorption and excitation of organic compounds, photophysical and photochemical processes, photochemical reactions, photosensitization and photocatalysis, photolysis of medicinal compounds and photo stabilization, high energy radiations.

3. Solid and Crystalline State

Formation of solids, types of solids, nature of amorphous and crystalline solids, crystal systems, determination of crystal structure, polymorphism.

4. Chemical Kinetics

Rates and order of reactions, influence of temperature and other factors on reaction rates, acid-base catalysis, decomposition of medicinal compounds, accelerated stability analysis, kinetics of enzyme catalyzed reactions.

5. Thermodynamics

First and second law of thermodynamics, thermochemistry, relationship between free energy, entropy and equilibrium constant, free energy functions and applications.

Books Recommended

1. Physical Chemistry P.W. Atkins 5th edition W.H. Freeman and company New York 2000
2. Physical Pharmacy Martin A.N., 4th Edition, Lea and Febiger, Philadelphia (1993).
3. Practical Pharmaceutical Chemistry Backet and Stenlake., Royal Press, London (1998).
4. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Eston, Pennsylvania, USA.

Third Professional

Preparation and Quality Control (Practical)

PHC-506
Cr. Hrs. 3

1. Preparation/synthesis, identification and purity determination of the following important pharmaceutical compounds as mentioned in B. P and U. S. P. Paracetamol, salicylic acid, methyl salicylate, azobenzene, benzoic acid. 5-Hydroxy-1, 3-benzoxazol-2-one, aspirin, p-nitroso phenol, 3-nitrophthalic acid, o-Chlorobenzoic acid.

2. Limit tests as mentioned in pharmacopoeias for lead, arsenic, chlorides, sulphates, iron and heavy metals

Books Recommended

1. Laboratory Techniques and Organic Preparations, Nousheen Mushtaq & Shamim Akhtar, Manual for PHC 506.
2. A Guide Book to Mechanisms in Organic Chemistry Peter Sykes. Fourth edition, Longman Group Ltd. (1978).
3. Analytical Application of Spectroscopy Greaser C.S. and Davies A.M.C. Royal Society of Chemistry, London (1988).
4. Introduction to organic chemistry By William H. Brown Saunders College Publishing 3rd edition (2002).
5. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Eston, Pennsylvania, USA.

Pharmaceutical Analysis - I

PHC-508
Cr. Hrs. 3

To study the principles and applications of the following methods in the drug analysis and development

1. Chemical Methods

Titrimetric methods, Gravimetric methods, Solvent extractions methods.

2. Electro Chemical Methods

Potentiometry, Polarography, Conductometry.

3. Optical Methods

Refractometry, Polarimetry, Fluorimetry.

4. Radiochemical Methods

Introduction to Radiopharmaceuticals, Analysis, Quality Control, Stability, Applications.

Books Recommended

1. Instrumental Methods of Chemical Analysis by Golden W. Evings, McGraw Hill London 5th Edition (1985).
2. Pharmaceutical Analysis – A Textbook of Pharmacy, Student and Pharmaceutical Chemistry Watson D.G. Churchill Livingston (1999).
3. Principle of Instrumental Analysis, Skoog Holter and Nieman 5th Edition (2000).
4. Quantitative Analysis, Theory and Practice by Lawrence W. Pott Harper and Raw Publisher New York (1987).
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London. 6th Edition (2006).

Fourth Professional

Pharmaceutical Analysis – II

PHC-608
Cr. Hrs. 3

To study the principles and applications of the following methods in the drug analysis and development

1. Spectroscopic Methods

Spectrophotometry (UV, Visible and Infrared), atomic absorption spectroscopy, mass spectrometry, nuclear magnetic resonance spectrometry, x-ray spectroscopy.

2. Chromatographic Methods

Thin layer chromatography, column chromatography, gas-liquid chromatography, high performance liquid chromatography, ion-exchange chromatography, size exclusion or gel chromatography.

Books Recommended

1. Principle of Instrumental Analysis, Skoog Holter and Nieman 5th Edition (2000).
2. Chromatographic Methods, R-Stock and CBE Rice 2nd Edition, Chapman and Hall Ltd and Science (1966).
3. Instrumental Methods of Chemical Analysis by Golden W. Eving, McGraw Hill London 5th Edition (1985).
4. Modern Infra-Red Spectroscopy, Barbara Stuart Publisher ACOL John Wily and Sons (1996).
5. Vogel's Textbook of Quantitative Organic Chemistry, Longman, London. 6th Edition (2006).

Medicinal Chemistry- I

PHC-610
Cr. Hrs. 3

1. **Introduction to medicinal chemistry.**
2. **Classification of drugs** based on sources, structure, site of action and mode of action.
3. **Preparation and properties of medicinally important heterocyclic compounds** such as: pyrrol, furan, thiophene, pyridine, pyrimidine and pyrazine. Five and six membered rings containing one heteroatom: indole, quinoline and Isoquinoline.
4. **Drug Discovery and development: Lead finding and modification**
5. **Introduction and types of drug targets**
6. **Structure activity relationship**
7. **Alkaloids** – atropine, morphine and related compounds (codeine, thebaine), ergotamine, reserpine, ephedrine.
8. **Hormones** (steroidal and proteinous): Testosterone, progesterone, estrogen, aldosterone, cortisol, insulin, glucagon, oxytocin and vasopressin.
9. **Pharmacodynamic features and drug development**
Stereochemistry and drug action
Forces involved in drug receptor interaction
Drug Receptor interaction; Theories

10. Pharmacokinetic features and drug development

Absorption: pH partition theory

Metabolism of Drug

- Introduction
- Reactions involved in Phase-I and Phase-II

11. Modern concepts in medicinal chemistry

Computational Chemistry

Combinatorial Chemistry

Biotechnology and drug discovery

Books Recommended

1. An introduction to medicinal chemistry by Graham L. Patrick oxford university press 2nd edition (2000).
2. Principles of Medicinal Chemistry, William O. Foye, Thomas L. Lemke and David A. Williams, Wolters Kluwer, Lippincott Williams & Wilkins 7th edition, (2013).
3. Textbook of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvold's. 12th edition, Wolters Kluwer, Lippincott Williams & Wilkins (2011).
4. Introduction to Medicinal Chemistry: How Drugs Act and Why, Alex. Gringauz, John Wiley & Sons Inc. (1997).
5. Introduction to organic chemistry By William H. Brown Saunders College Publishing 3rd edition
6. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Pnen, Inc., USA (1992).

Fifth Professional

Medicinal Chemistry –III

PHC-710
Cr. Hrs. 3

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

1. Antibacterial / Antibiotics

Sulphonamides such as sulfamethoxazole, sulfadiazine, sulfafurazole. Penicillin, Cephalosporine, Streptomycin, Chloramphenicol, Tetracyclines, Kanamycin and Erythromycin.

2. Antimalarial agents

such as 4-aminoquinolines, 8-aminoquinolines, 9-amino acridine, biguanides, pyrimidine, analogues, mefloquine, cinchona alkaloids.

3. Anthelmintics

such as piperazine derivatives, thiabendazole, mebendazole, pyrantel.

4. Antitubercular drugs

such as ethambutol, isonicotinic acid, hydrazide rifampicin, pyrazinamide, cycloserine, ethambutol, ethionamide, streptomycin, kanamycin, para aminobenzoic acid, rifamycin, fluoroquinolones

5. Hypoglycemic agents

such as sulfonylureas tolbutamide, chlorpropamide, acetohexamide, glipizide, glyburide

6. Cardiovascular agents:

Antianginal agents and vasodilators, antiarrhythmic drugs, antihypertensive agents, angiotensin-converting enzymes inhibitors, antihyperlipidemic agents, anticoagulants

- 7. Adrenergic and cholinergic agents, neurotransmitters, receptors, agonists and antagonists**
- 8. Vitamins** (water and fat soluble). B1, B2, B6, B12, folic acid, nicotinic acid, biotin, pantothenic acid, ascorbic acid A, D, E and K

To study the Occurrence, properties, preparation and applications of the following medicinally active inorganic compounds.

Aluminum Hydroxide, Ammonium Chloride, Sodium Carbonate, Magnesium Carbonate, Lithium Carbonate, Sodium Nitrite, Calcium Gluconate, Ferrous Fumarate, Ferrous Sulfate and Silver nitrate

Books Recommended

1. Principles of Medicinal Chemistry, William O. Foye, Thomas L. Lemke and David A. Williams, Wolters Kluwer, Lippincott Williams & Wilkins 7th edition, (2013).
2. Textbook of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvold's. 12th edition, Wolters Kluwer, Lippincott Williams & Wilkins (2011).
3. Introduction to Medicinal Chemistry: How Drugs Act and Why, Alex. Gringuaz, John Wiley & Sons Inc. (1997).
4. Burger's Medicinal Chemistry and Drug Discovery edited by E. Wolf, 6th edition, Wiley-Inter Science, New York (2003).
5. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Pnen, Inc., USA (1992).

Pharm. D. (Deficiency) Courses

1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHC - 303(D)	Pharmaceutical Chemistry (Organic and Inorganic)	2	PHC - 406(D)	Pharmaceutical Chemistry Physical (Lab)	2
PHC - 505(D)	Pharmaceutical Chemistry (Theoretical Basis of Quality Control)	2	PHC - 707(D)	Pharmaceutical Chemistry (Analysis)	2
PHC - 710(D)	Pharmaceutical Chemistry (Medicinal)	3	-	-	-
Total 5 Courses making 11 Credit Hours in one year					

First Semester

Organic and Inorganic

PHC-303
Cr. Hrs. 2

- 1. Organic reactions:** Baeyer-Villiger oxidation; Diels Alder reaction; Grignard's reaction, metal hydride reduction and Wolff-Krishner reduction, Friedel-Craft's reaction, Perkin reaction, Cannizzaro reaction.
- 2. Carbonium ion rearrangements:** Pinacol-pinacolone, Wagner-Meerwein, Wolf, Hofmann and Beckmann rearrangements.
- 3. Carbanions:** condensation reaction (Aldol condensation; Favorskii rearrangement; Wittig reaction).
- 4. Inorganic Drugs**
Occurrence, preparation, physical characteristics, chemical properties, purity test, incompatibilities, assay and pharmaceutical uses of inorganic drugs such as:

Aluminum hydroxide
Sodium carbonate
Sodium thiosulphate
Magnesium carbonate
Lithium carbonate
Calcium gluconate
Calcium chloride
Ferrous fumarate
Ferrous gluconate
Silver nitrate
Iodine
Boric acid

Ammonium chloride
Sodium chloride
Sodium tetraborate (borax)
Potassium chloride
Sodium nitrite
Calcium carbonate
Calcium lactate
Ferrous sulfate
Iron polysaccharide
Antimony gluconate
Hydrogen peroxide
Zinc oxide

Books Recommended

1. A Guide Book to Mechanisms in Organic Chemistry, Peter Sykes. Fourth edition, Longman Group Ltd. (1978).
2. Organic Chemistry Graham Solomons T.W. Fifth edition, John Wiley & Sons, Inc. (1992).
3. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Easton, Pennsylvania, USA.
4. Vogel's Text Book of Quantitative Inorganic Analysis including Elementary Instrumental Analysis, Longman, London. 6th Edition (2000).
5. Mellor's Modern Inorganic Chemistry, by G.D. Parkers, Longman Green and Co., Ltd., London (1956).

Theoretical Basis of Quality Control

PHC-505
Cr. Hrs. 2

1. Pharmaceutical sciences and its relation to other sciences.
2. Brief historical outline.
3. Raw material for drugs.
4. Sources of impurities in pharmaceuticals.
5. Quantitative and qualitative analysis (general information).
6. Standardization of pharmaceuticals and formulated products.
7. Quality control system for drugs and pharmaceuticals.
8. Causes of poor quality and general requirements.
9. Total quality management, a new approach.
10. Validation methodology and statistical treatment of analytical data.

Books Recommended

1. Pharmaceutical Analysis – A Textbook of Pharmacy, Student and Pharmaceutical Chemistry Watson D.G. Churchill Livingstone (1999).
2. Quantitative Analysis, Theory and Practice by Lawrence W. Pott Harper and raw Publisher New York (1987).
3. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Easton, Pennsylvania, USA.
4. United State Pharmacopoeia, United State pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockville M.D. 20852 USA. 2008
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London. 6th Edition (2006).

Medicinal Chemistry

PHC-710
Cr. Hrs. 3

1. **DNA recombinant technology/genetic engineering** (with reference to drug designing).
2. **To study the chemistry, structure, mechanism of action, structure activity relationship and therapeutic applications of the following.**
 - a. Hypoglycemic agents such as sulfonylureas tolbutamide, chlorpropamide, acetohehexamide, glipizide, glyburide.
 - b. Antibiotics such as penicillin, cephalosporins, streptomycin, chloramphenicol, tetracyclines, kanamycin and erythromycin.
 - c. Antimalarial agents such as 4-aminoquinolines, 8-aminoquinolines, 9-amino acridines, biguanides, pyrimidine, analogues, mefloquine, cinchona alkaloids.
 - d. Anthelmintics such as piperazine derivatives, thiabendazole, medendazole, pyrantal.
 - e. Antiviral agents such as acyclovir, tromantidine hydrochloride, ribavirin.
 - f. Immunosuppressive agents such as azathioprine, cyclosporine.

- 3. To study the biosynthesis, drug designing and action of the following:**
- Autocoids such as prostaglandins, leukotrienes and eicosanoids.
 - Adrenergic and cholinergic agents, neurotransmitters, receptors, agonists and antagonists.

Books Recommended

- Principles of Medicinal Chemistry William O. Foye, Thomas L. Lemke and David A. William, 6th edition, (2008).
- Textbook of Organic Medicinal and Pharmaceutical Chemistry Wilson and Gisvold's. 12th edition, Lippincott-Raven Publisher (1998).
- Burger's Medicinal Chemistry and Drug Discovery edited by E. Wolf, 6th edition, Wiley-Inter Science, New York (2003).
- Introduction to Medicinal Chemistry Alex. Gringuaz, Wiley-Vach Inc. (1997).
- The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Pnen, Inc., USA (1992).

Second Semester

Physical Chemistry (Practical)

PHC-406
Cr. Hrs. 2

- Distillation of a mixture.
- Distillation of an azeotropic mixture with minimum/maximum boiling point.
- Determination of variation of miscibility with temperature.
- Absorption curve of an indicator as a function of pH.
- Composition of a complex in solution.
- Determination of molar refraction of a solid substance by dissolving it in a solvent.
- Molecular weight determination.
- Determination of the first-order rate constant for acid catalyzed hydrolysis of a given sample.
- Determination of the first-order rate constant for the decomposition of a given sample.
- Determination of effect of change of temperature in the rate of reaction.
- To study the stability of a drug subjected to various stress conditions.
- Determination of heat of solutions from solubility.

Books Recommended

- Pharmaceutical Analysis, Higuchi T. and Brochmann Hanssen E., Interscience, New York.
- Physical Chemistry Barrow G.M. McGraw-Hill, London (1973).
- Physical Chemistry by Fazal I Hussain, 3rd Edition (1991).
- Physical Chemistry, Barrow G.M. McGraw-Hill, London (1973).
- Textbook of Physical Chemistry by Sameul Glasstone, 2nd Edition, MC Millan & Company Ltd. (1946).

Pharmaceutical Analysis (Practical)

PHC-406
Cr. Hrs. 2

To study the principles and applications of spectroscopic and chromatographic method with special reference to

1. Assay of pharmaceutical compounds.
2. Separation, identification and quantitation of a drug.
3. Method, development procedure of a drug.
4. Experimental methodology of validation of a drug.

Books Recommended

1. British Pharmacopoeia, Stationary Press, Royal Society of Pharmaceutical Press, London (2005).
2. Instrumental Methods of Chemical Analysis by Golden W. Evings, McGraw Hill London 5th Edition (1985).
3. Principle of Instrumental Analysis, Skoog Holter and Nieman 5th Edition (2000).
4. United State Pharmacopoeia, United State Pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockville M.D. 20852 USA. 2008
5. Vogel's Textbook of Quantitative Organic Chemistry, Longman, London. 6th Edition (2006).

The background features a dark blue gradient with a glowing molecular structure of interconnected spheres and lines. In the foreground, a large, 3D-rendered blue pill capsule is shown at an angle, partially overlapping the text.

Department of **Pharmacology**



The Department of Pharmacology is one of the important Departments of the Faculty of Pharmacy and Pharmaceutical Sciences since 1973, not only sharing a major load at the under graduate level but also preparing students to fill the gap by suitably qualified manpower in the field of pharmacy at post graduate levels. The expansion of the department and graduate programs in the areas of modern pharmacology including Neuropharmacology, Toxicology and Biochemical Pharmacology is expected to place the department among high research ranking Departments of the University.

The major academic objectives of the department are to facilitate basic and applied research, educate under graduate, graduate and professional students in various disciplines and provide academic excellence. Department of Pharmacology has so far produced a great number of Ph.Ds. in the Faculty of Pharmacy and Pharmaceutical Sciences and a large number of M. Phil and M. Pharm. The Department is composed of highly competent primary faculty, research faculty and technical support staff.

Faculty

Pharmacology



Dr. Afshan Siddiq

Chairperson and Associate Professor

Qualification
Ph.D., M. Phil., B. Pharm.
(University of Karachi)
Year of Association
2006
Subjects of Interest
Systemic Pharmacology, Biochemistry, Toxicology
Area of Research Interest
Biochemical Pharmacology
Email
afshan@uok.edu.pk
afshanpharma@gmail.com
Phone Number
(+92-21) 99261300-7 Ext. 2206



Dr. Syeda Afroz

Associate Professor

Qualification
Ph.D., M. Phil., B. Pharm.
(University of Karachi)
Year of Association
2006
Subjects of Interest
General Pharmacology
Area of Research Interest
Neuropharmacology
Email
safroz@uok.edu.pk
ayaz_london@yahoo.com
Phone Number
(+92-21) 99261300-7 Ext. 2206



Dr. Sadia Ghausia Baig

Assistant Professor

Qualification
Ph.D., M. Phil., B. Pharm.
(University of Karachi)
Year of Association
2006
Subjects of Interest
Biochemistry, Neuropharmacology
Area of Research Interest
Biochemical Pharmacology
Email
sgbaig@uok.edu.pk
Phone Number
(+92-21) 99261300-7 Ext. 2206

Faculty

Pharmacology



Dr. Nuzhat Sultana

Assistant Professor

Qualification

Ph.D., M. Phil., B. Pharm.
(University of Karachi)

Year of Association

2012

Subjects of Interest

General Pharmacology, Toxicology

Area of Research Interest

**Neurobehavioral Pharmacology,
Biochemical, Hematological and
Toxicological Screening**

Email

nuzhat.sultana@uok.edu.pk

nuztsultana@gmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2206



Dr. Azra Riaz

Assistant Professor

Qualification

Ph.D., M.Phil., B. Pharm.
(University of Karachi)

Year of Association

2012

Subjects of Interest

Pharmacology, Physiology, Biochemistry

Area of Research Interest

**Biochemical and Hematological Parameters,
Coagulation, Inflammation and
Neuropharmacology**

Email

azra.wasif@uok.edu.pk

azrawasif13@hotmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2206



Dr. Saira Saeed Khan

Assistant Professor

Qualification

Ph.D., M. Phil., B. Pharm.
(University of Karachi)

Year of Association

2012

Subjects of Interest

**Systemic Pharmacology, Biochemistry,
Clinical Pharmacology**

Area of Research Interest

**Neuropharmacology, Biochemical and
Hematological Studies**

Email

saira.khan@uok.edu.pk

shah_khan1983@hotmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2206

Faculty

Pharmacology



**Dr. Shadab
Ahmed**

Assistant Professor

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association
2012

Subjects of Interest

**Physiology, Pathology, Biochemistry,
Pharmacology**

Area of Research Interest

Neuropharmacology

Email

a_shadab@uok.edu.pk

a_shadab@hotmail.com

Phone Number

(+92-21) 99261300-7 Ext. 2206



**Dr. Sana
Sarfaraz**

Assistant Professor

Qualification

**Ph.D., M. Phil., Pharm. D.
(University of Karachi)**

Year of Association
2019

Subjects of Interest

**Physiology, Nutraceuticals, Clinical
Pharmacology**

Area of Research Interest

**Neuropharmacology, Diabetes,
Hematological and Biochemical Screening**

Email

ssarfaraz@uok.edu.pk

sana.sarfraz@live.com

Phone Number

(+92-21) 99261300-7 Ext. 2206



Dr. Adnan Iqbal

Lecturer

Qualification

**Ph.D., M. Phil., Pharm. D.
(University of Karachi)**

Year of Association
2019

Subjects of Interest

**Neuropharmacology, Nanotechnology,
Haematology**

Area of Research Interest

**Psychopharmacology, Haematology,
Pharmacogenetics**

Email

adnaniqbal@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2206

Board of Studies

Dr. Afshan Siddiq

Chairperson and Associate Professor

Dr. Syeda Afroz

Associate Professor

Dr. Sana Sarfaraz

Assistant Professor

Dr. Adnan Iqbal

Lecturer

Prof. Dr. Fareeda Islam

Head, Department of Pharmacology,
Karachi Medical and Dental College, Karachi

Prof. Dr. Mahy Rukh

Department of Pharmacology,
Dow University of Health Sciences (Ojha Campus), Karachi

Dr. Subia Jamil

Associate Professor
Department of Pharmacology,
Jinnah University for Women, Karachi.

Dr. Syed Saad Hussain

Senior Manager,
Medical Affairs and Business Development,
Tabros Pharma (Pvt.) Ltd.
Head Office, 32-1/C,
Block 6, PECHS, Block-6, Karachi.

Pharm. D. Courses

First Professional					
1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHL-305	Islamic Learning / Pakistan studies	2	PHL-308	Pharmacology Physiology and Histology-II	3
PHL-307	Pharmacology- Physiology and Histology - I	3	PHL-310	Pharmacology- Pharmaceutical Biochemistry II	3
PHL-309	Pharmacology- Pharmaceutical Biochemistry-I	3	PHL-314	Pharmacology- Anatomy	2
PHL-311	Pharmacology- Pharmaceutical Biochemistry (Practical)	3	-	-	-
Second Professional					
PHL-407	Pharmacology- Physiology and Histology (Practical)	3	PHL-410	Pharmacology- Systemic Pharmacology- I	3
PHL-409	Pharmacology and Therapeutics	3	-	-	-
PHL-413	Pharmacology- Pathology	2	-	-	-
Third Professional					
PHL-507	Pharmacology- Systemic Pharmacology-II	3	PHL-510	Pharmacology- Pharmacology Lab. - I	3
PHL-509	Pharmacology- Pathology (Practical)	2	-	-	-
Fourth Professional					
PHL-609	Pharmacology- Systemic Pharmacology- III	3	PHL-612	Pharmacology Lab. - II	3
Fifth Professional					
PHL-711	Pharmacology- Clinical Pharmacology	2	PHL-712	Pharmacology- Toxicology	2
Total 18 Courses, making 48 Credit Hours in five years.					

First Semester First Professional

Islamic Learning / Pakistan Studies

PHL-305
Cr. Hrs. 2

1. The Need Religion

A critical analysis of the sources of human knowledge and importance of Wahi (Divine revelation).

2. Islamic Concept of Life

Islamic concept of universe, the position of mankind, the earth, the goal for men's activities.

3. Islamic Beliefs

Islam and aqida, the role of iman in character building and in the development civilization. Aqida-tawhid (belief in unity of God) its details and its impact on character. Iman bil Malaikah (belief in angels). Aqida risalat (belief in prophethood) its details. Its importance. In the development of Islamic civilization, the distinguishing features of Mohammad (PBUH) Prophethood, the doctrine of the last prophet. Iman bil kutub (Belief in the revealed books).

Aqida Akhrat (Belief in the life hereafter) its details, quranic style of arguments on the life hereafter. The impact of Aqida Akhrat on individual and society. A comparison and Islamic concept of Ibadat with other religions. Salat (Prayer). Zakat, its philosophy, rates and minimum zakat amount, its impact on economy. Sawm (Fasting). Haj (Pilgrimage): Manasik and its importance.

4. Pakistan Studies

Ideology of Pakistan and its basic elements, two nation theory; Aims and objective for Establishment of Pakistan; The Khilafat Movement. The struggle for Islamic System (with the special reference to constitution of Pakistan 1973); The common problems of Muslim Ummah and their solutions.

5. Islamic Moral Values

Philosophy of morality in Islamic moral Values.

Books Recommended

1. Kursheed Ahmed, Islam ka Nazariya hayat.
2. Shiblee Nuamani/Syed Suleman Nadvi. Seerat-un-Nabi (SAWW) Jild-e-Kamil.

Physiology and Histology-I

PHL-307
Cr. Hrs. 3

1. Physiology of Nerve and Muscle

Chemical changes during muscle contraction, nerve action potential, skeletal, smooth muscle and cardiac excitation contraction.

2. Blood

Composition, functions and genesis of formed elements. RBC, WBC and platelet. Fate of RBC, jaundice, reaction of blood, blood groups. Rh factors, ESR, blood volume, function of spleen, blood coagulation, hemophilia, classification of anemias.

3. Circulatory System

Properties of cardiac muscles, origin and conduction of heart beat, cardiac cycle, ECG, heart sounds, cardiac output, stroke volume and heart rate. Nerve supply to heart, coronary, pulmonary and skin circulation. Blood pressure, vasomotor center. Arterial pulse, venous pulse, hemorrhage, circulatory changes in exercise, composition and circulation of lymph, shock.

4. Skin

Structure and functions of skin, temperature regulation.

5. Digestive System

Mastication, deglutition, digestive juices (gastric, pancreatic, bile and intestinal juices) their composition, function and mechanism of secretions. Movement of stomach and intestine, function of large intestine, defecation, functions of liver and gall bladder.

Books Recommended

1. Arthur C. Guyton and John E. Hall. Textbook of Medical Physiology. 13th Edition, 2015, W.B. Saunders, Philadelphia.
2. Barbara Young, Philipwoord Ford, Geraldine o' Dowd Wheater's Functional Histology: A Text and Colour Atlas. 6th Edition, 2013.
3. Douglas F. Paulsen. Basic Histology: Examination and Board Review. 5th edition, 2010, Prentice Hall Internal Inc.
4. Frederic H. Martini. Fundamentals of Anatomy and Physiology. 10th Edition, 2014, Prentice Hall, New Jersey.
5. Gerard J. Tortora & Bryan Derrickson. Principles of Anatomy and Physiology. 14th Edition, 2013, John Wiley & Sons, New York.

Pharmaceutical Biochemistry-I

PHL-309
Cr. Hrs. 3

1. Introduction and Basic Biochemical Principles

Role of pharmaceutical biochemistry in the health profession, nature of biochemical reactions.

2. Basic Chemistry of Biomolecules

Carbohydrates; Chemistry, classification, reactions, optical activity, biological and pharmaceutical importance of carbohydrates.

Lipids; Chemistry of fatty acids and lipids classifications, (saponifiable and non saponifiable lipids, simple, complex and derived). Reactions of fatty acids and other lipids. Essential fatty acids, biological and pharmaceutical importance of lipids.

Proteins and Amino acids; Chemistry, classification, reactions of proteins and amino acids. Organizational level, macromolecular nature, biological and pharmaceutical importance of proteins and amino acids.

3. Metabolic Fate of Biomolecules

Carbohydrates; Brief digestion and absorption, aerobic and anaerobic breakdown of glucose, glycolysis, pentose phosphate pathway, glycogenolysis, gluconeogenesis, citric acid cycle, energetics of various metabolic processes.

Lipids; Brief digestion and absorption, oxidation of fatty acids through beta oxidation, Biosynthesis of fatty acids, neutral lipids, and cholesterol.

Proteins and Amino-acids; Brief digestion and absorption, metabolism of essential and non essential amino acids, Biosynthesis and catabolism of Haemins and porphyrin compounds.

4. Bioenergetics

Principles of bioenergetics, electron transport chain and oxidative phosphorylation.

5. 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 enzyme (Chymotrypsin, Ribonuclease).

Books Recommended

1. Alisa Peet, Michael A. Lieberman, Allan Marks. Marks' Basic Medical Biochemistry. 4th edition, 2012, Lippincott Williams & Wilkins.
2. David L. Nelson, Michael M. Cox. Lehninger Principles of Biochemistry. 6th Edition, 2012, W.H. Freeman.
3. MN Chatterjee & Rana Shinde. Text book of medical biochemistry. 8th Edition. 2011 Jaypee publishers.
4. Pamela C. Champe & Richard A. Harvey. Lipincott's Illustrated Review: Biochemistry. 6th Edition, 2013, Lippincott Williams & Wilkins, Philadelphia.
5. Robert K. Murray. Harper's Illustrated Biochemistry. 30th Edition, 2015, Lange Medical Books, McGraw Hill, New York.

Pharmaceutical Biochemistry (Practical)

PHL-311
Cr. Hrs. 3

1. Qualitative Analysis

Carbohydrates, amino acids, peptides and proteins. Lipids and sterols (Cholesterol) bile salts and bilirubin. Blood sugar analysis, uric acid, bilirubin, cholesterol and creatinine.

2. Quantitative Analysis

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 constituents of urine sugar. Uric acid, bilirubin, cholesterol and creatinine

Books Recommended

1. Alisa Peet, Michael A. Lieberman, Allan Marks. Marks' Basic Medical Biochemistry. 4th edition, 2012, Lippincott Williams & Wilkins.
2. David L. Nelson, Michael M. Cox. Lehninger's Principles of Biochemistry. 6th Edition, 2012, W.H. Freeman.
3. MN Chatterjee & Rana Shinde. Text book of medical biochemistry. 8th Edition. 2011 Jaypee publishers.
4. Pamela C. Champe & Richard A. Harvey. Lipincott's Illustrated Review: Biochemistry. 6th Edition, 2013, Lippincott Williams & Wilkins, Philadelphia.
5. Robert K. Murray. Harper's Illustrated Biochemistry. 30th Edition, 2015, Lange Medical Books, McGraw Hill, New York.

Second Professional

Physiology and Histology (Practical)

PHL-407
Cr. Hrs. 3

1. Introduction to Experimental Physiology

2. Blood

Determination of hemoglobin. Determination of ESR, RBC count, WBC count, differential leucocytes count, bleeding and clotting time, blood groups.

3. Respiration

Estimation of vital capacity and its relation to posture and standard vital capacity. Determination of tidal volume. Demonstration of artificial respiration.

4. C.V.S.

Recording of arterial pulse, recording of arterial B.P.

5. Eye

Visual acuity, far vision, near vision and field of vision.

6. C.N.S.

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

7. Histology

Demonstration, preparation and staining of the slides, histological examination of slides, epithelium, connective tissue, muscle tissue, organ system - lungs, kidney, appendix, skin, gall bladder, stomach, intestine.

Books Recommended

1. Arthur C. Guyton and John E. Hall. Textbook of Medical Physiology. 13th Edition, 2015, W.B. Saunders, Philadelphia.
2. Barbara Young, Philip Woodford, Geraldine o' Dowd Histology: A Text and Colour Atlas 6th Edition, 2013.
3. Douglas F. Paulsen. Basic Histology: Examination and Board Review. 5th Edition, 2010, Prentice Hall Internal Inc.
4. Frederic H. Martini. Fundamentals of Anatomy and Physiology. 10th Edition, 2014, Prentice Hall, New Jersey.
5. Gerard J. Tortora & Bryan Derrickson. Principles of Anatomy and Physiology. 14th Edition, 2013, John Wiley & Sons, New York.

Pharmacology and Therapeutics

PHL-409
Cr. Hrs. 3

1. Introduction

History and scope of Pharmacology, classification of Pharmacology, classification of drugs and their sources.

2. Definitions

Bioavailability, bioequivalence, therapeutic index, potency, efficacy, risk benefit ratio, selective toxicity, plasma half-life, dose response curve, desensitization tachyphylaxis.

3. **Drugs Delivery System**

Advantages and disadvantages of oral medication. Advantages and disadvantages non-oral medication.

4. **Pharmacokinetics**

Drug solubility and passage of drugs across body membranes, plasma concentration of drugs and various factors affecting it. Factors affecting absorption, distribution, biotransformation and excretion.

5. **Pharmacodynamics**

Drug receptors and theories, agonist and antagonists, mechanism of drug action, specificity of drug action, and factors modifying the action.

6. **Drugs Acting on Blood**

Antianemic (Vit B12, folic acid, iron). Coagulants and anticoagulants.

7. **Autonomic Nervous System**

Introduction to autonomic pharmacology.

8. **Drugs Acting on ANS**

Sympathetic agonists, sympathetic antagonists, parasympathetic agonists and antagonists, anticholinesterases, ganglion blockers and neuromuscular blockers.

Books Recommended

1. Anthony Trevor, Bertram Katzung, Susan Masters, Marieke Knuidering-Hall. Katzung & Trevor's Pharmacology Examination and Board Review, 11th Edition, 2015. Lange Medical Books.
2. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.
3. David E. Golan, Armen H. Tashjian, Jr. Ehrin J. Armstrong, April W. Armstrong. Principles of Pharmacology "The Pathophysiologic Basis of Drug Therapy". 3rd Edition (2011). Lippincott Williams & Wilkins.
4. Goodman & Gilman's. The Pharmacological Basis of Therapeutics 12th Edition, 2010. McGraw-Hill, USA.
5. Rang H.P., Dale M.M. Rang & Dale's Pharmacology, 8th Edition, 2015. Churchill Living Stone, England.

Pharmacology Pathology

**PHL-413
Cr. Hrs. 2**

1. Scope of Pathology and Concept of Diseases

2. Definitions and Terminologies

3. Response of Body to Injury and Infection

Acute inflammation, chronic inflammation. Immunity, allergy and hyper sensitivity.

4. Specific Diseases

Peptic and duodenal ulcer, hypertension. M.I., SLE, Nephrotic syndrome, COPD.

5. Diagnosis of Cancer

Fate, survival and prognosis of tumors. Leukemia, malignant carcinoma, sarcoma lymphoma.

Books Recommended

1. David E. Golan, Armen H. Tashjian, Jr. Ehrin J. Armstrong, April W. Armstrong. Principles of Pharmacology. "The Pathophysiologic Basis of Drug Therapy". 3rd Edition (2011).
2. Martin Gwent Lewis and Thomas K. Barton. Appleton & Lange's Review of General Pathology. 4th Edition, 2002, Prentice Hall International Inc.
3. Michael D. Randall and Karen E Neil. Disease Management, 2nd Edition, 2008.
4. Ramzi S. Cotran, Vinay Kumar & Stanley L. Robbins. Robbins & Cotran Pathologic Basis of Disease. 9th Edition, 2014. W.B. Saunders Company, Philadelphia.
5. Russell J. Greene and Norman D. Harris. Pathology and Therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice. 3rd edition, 2008. Chapman & Hall, London.

Third Professional

Systemic Pharmacology-II

PHL-507
Cr. Hrs. 3

1. Drugs Acting on Cardio Vascular System

Angina and antianginal drugs. Thrombosis and thrombolytic agents, Congestive heart failure and its treatment. Cardioactive glycosides, Bipyridines, [®]-adrenergic blockers. Xanthine derivatives, vasodilators. Antiarrhythmic drugs, Hyperlipidemia and hypocholesterolemic agents. Hypertension, antihypertensives and diuretics.

2. Dermatological Agents

Factors affecting topical absorption of drugs, Pharmacology of dermatological agents.

3. Drugs Acting on Respiratory System

Drugs used for Cough: Antitussives, demulcents, steam inhalation, local anesthetics. Narcotic antitussives, non-narcotic antitussives, expectorants and mucolytic agents. Bronchodilators, Corticosteroids and other anti-inflammatory drugs, Muscarinic receptor antagonists, Mast cell stabilizers; β agonists, Leukotriene inhibitors.

4. Anti Neoplastics

Drug used for treatment of cancer including alkylating agents, mitotic spindle poisons, podophyllotoxins, antibiotic, miscellaneous, topoisomerase, inhibitors and monoclonal antibodies.

Books Recommended

1. Anthony Trevor, Bertram Katzung, Susan Masters, Marieke Knuidering-Hall. Katzung & Trevor's Pharmacology Examination and Board Review, 11th Edition, 2015. Lange Medical Books.
2. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.
3. David E. Golan, Armen H. Tashjian, Jr. Ehrin J. Armstrong, April W. Armstrong. Principles of Pharmacology "The Pathophysiologic Basis of Drug Therapy". 3rd Edition (2011). Lippincott Williams & Wilkins.
4. Goodman & Gilman's. The Pharmacological Basis of Therapeutics 12th Edition, 2010. McGraw-Hill, USA.
5. Rang H.P., Dale M.M. Rang & Dale's Pharmacology, 8th Edition, 2015. Churchill Living Stone, England.

Pharmacology Pathology (Practical)

PHL-509
Cr. Hrs. 2

1. Study of Pathological Slides of Various Pathological Conditions

Acute inflammation; chronic inflammation; chronic specific inflammation. Different types of degeneration. Thrombosis, embolism, infarction, necrosis, gangrene, hyperplasia, metaplasia, pigmentation, calcification, C.B.C., papilloma, adenoma, chondroma, fibroma, neofibroma, squamous cell carcinoma, Basal cell carcinoma, transitional cell carcinoma.

Adenocarcinoma, fibrocarcinoma, rhabdomyosarcoma, leiomyosarcoma, lymphosarcoma, liposarcoma, reticular cell sarcoma, Hodgkin's disease, breast carcinoma, osteogenic, sarcoma, osteoclastoma.

2. Examination of Different Body Fluids in Various Pathological Conditions

Urine complete examination, stool examination, blood complete examination. Semen examination, cerebrospinal fluid examination, pericardial fluid examination, pleural fluid examination, aseptic fluid examination, blood sugar, blood urea, blood cholesterol etc.

3. Tests for Various Specimens of Clinical Importance

Techniques of clinical blood examination for various diseases, gastric analysis, Tests for liver function and renal function. Test for endocrine abnormalities, biopsies and cytological techniques.

Books Recommended

1. David E. Golan, Armen H. Tashjian, Jr. Ehrin J. Armstrong, April W. Armstrong. Principles of Pharmacology. "The Pathophysiologic Basis of Drug Therapy". 3rd Edition (2011).
2. Martin Gwent Lewis and Thomas K. Barton. Appleton & Lange's Review of General Pathology. 4th Edition, 2002, Prentice Hall International Inc.
3. Ramzi S. Cotran, Vinay Kumar & Stanley L. Robbins. Robbins & Cotran Pathologic Basis of Disease. 9th Edition, 2014. W.B. Saunders Company, Philadelphia.
4. Russell J. Greene and Norman D. Harris. Pathology and Therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice. 3rd edition, 2008. Chapman & Hall, London
5. Stephen J. McPhee, Maxine Papadakis, Lawrence M. Tierney . Current Medical Diagnosis and Treatment, 54th Edition, 2015, Lange Medical Books, McGraw-Hill Medical Publishing Division, London.

Fourth Professional

Systemic Pharmacology - III

PHL-609
Cr. Hrs. 3

1. Drug Acting on Central Nervous System

Hypnotic and sedatives, analgesics, narcotic analgesics and opioids antagonists, anxiolytics, antipsychotics, antidepressants, antimanic, cerebral stimulants, spinal cord stimulants, drug treatment of epilepsy, drug treatment of parkinsonism and other movement disorders. General and local anesthetics.

2. Insulin, thyroxin and other agents affecting endocrine function

3. Ocular Pharmacology

Use of autonomic agents in eyes, chemotherapy of diseases in eye. Use of immunomodulatory drugs for ophthalmic therapy; Use of anesthetics in ophthalmic procedures.

4. Oxytocic drugs

5. Drugs Acting on Reproductive System

Contraceptives; fertility drugs; testosterone and contraception in males; erectile dysfunction and pharmacotherapy.

Books Recommended

1. Anthony Trevor, Bertram Katzung, Susan Masters, Marieke Knuidering-Hall. Katzung & Trevor's Pharmacology Examination and Board Review, 11th Edition, 2015. Lange Medical Books.
2. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.
3. David E. Golan, Armen H. Tashjian, Jr. Ehrin J. Armstrong, April W. Armstrong. Principles of Pharmacology "The Pathophysiologic Basis of Drug Therapy". 3rd Edition, 2011. Lippincott Williams & Wilkins.
4. Goodman & Gilman's. The Pharmacological Basis of Therapeutics 12th Edition, 2010. McGraw-Hill, USA.
5. Rang H.P., Dale M.M. Rang & Dale's Pharmacology, 8th Edition, 2015. Churchill Living Stone, England.

Fifth Professional

Clinical Pharmacology

PHL-711
Cr. Hrs. 2

1. Introduction to Clinical Pharmacology

Terminology, basic components and scope.

2. Role of Drug Monitoring in Therapeutics

Patient profile, diseases profile, drug profile, monitoring responses, monitoring plasma concentration.

3. Factors Affecting Drug Response

Pharmacogenetics, drug interactions.

4. Development of New Drugs

Process of drug development, preclinical studies, types of clinical trials, choice of patients, exclusion criteria of patients.

5. Drugs in Pregnancy

Prescribing in pregnancy, harmful effects on fetus, pharmacokinetics in pregnancy.

6. **Drugs in Infants and Children**

Practical aspects of prescribing drugs, pharmacokinetics.

7. **Drugs in Elderly**

Pharmacokinetics changes, Pharmacodynamic changes.

8. **Drug Toxicity**

Adverse drug reactions, monitoring adverse drug reactions, risk benefit ratio.

Books Recommended

1. Arthur J. Atkinson Jr, Shiew-Mei Huang, Juan J.L. Lertora, Sanford P. Markey. Principles of Clinical Pharmacology. 3rd edition, 2012, Academic Press.
2. P.V. Rataboli. Clinical Pharmacology and Rational Therapeutics, 2nd edition, 2010, Ane Books Pvt Ltd.
3. Gerard A. McKay, Matthew R. Walters. Clinical Pharmacology and Therapeutics. 9th edition, 2013, Wiley Blackwell.
4. Mary Anne Koda Kimble. Koda-kimble and Young's Applied Therapeutics: "The Clinical Use of Drugs" 10th Edition, 2012. Lippincott Williams & Wilkins USA.
5. Roger Walker and Cate Whittlesea. Clinical Pharmacy and Therapeutics, 5th Edition (2011).

Second Semester **First Professional**

Physiology and Histology-II

**PHL-308
Cr. Hrs. 3**

1. **Respiratory System**

Mechanics of respiration, intrathoracic, intrapulmonary pressure. pulmonary ventilation. Lung's volume and capacities. Composition of inspired air, expired air and alveolar air, carriage of oxygen and CO₂ by the blood. Regulation of breathing (nervous and chemical control).

2. **Urinary System**

Urine formation, composition of urine, urea clearance. Formation of concentrated and dilute urine, regulation of osmolarity, and pH (acidic and basic urine), process of micturition (nervous control), renal failures.

3. **Nervous System**

Spinal reflexes, reflex regulation of movement and posture. Cerebral cortex functions, voluntary movements, descending tracts of spinal cord. Basal ganglia, cerebellum, thalamus, C.S.F. Autonomic nervous system.

4. **Special senses**

Elementary knowledge of structure and function of the special senses.

5. Endocrinology

Definition of hormone. Nature of different types of hormones. Mechanism of action of hormones including pituitary hormones with abnormalities, thyroid gland with pathologies para thyroid hormone, pancreatic hormone with diabetes mellitus, adrenal glands with Cushing syndrome, Addison's disease. Male and female sex hormones.

6. Histology

Underlying principles of histological techniques and staining specific tissues. Staining of paraffin and frozen sections.

Books Recommended

1. Arthur C. Guyton and John E. Hall. Textbook of Medical Physiology. 13th Edition, 2015, W.B. Saunders, Philadelphia.
2. Barbara Young, Philip Woodford, Geraldine O'Dowd Wheeler's Functional Histology: A Text and Colour Atlas. 6th Edition, 2013.
3. Douglas F. Paulsen. Basic Histology: Examination and Board Review. 5th edition, 2010, Prentice Hall International Inc.
4. Frederic H. Martini. Fundamentals of Anatomy and Physiology. 10th Edition, 2014, Prentice Hall, New Jersey.
5. Gerard J. Tortora & Bryan Derrickson. Principles of Anatomy and Physiology. 14th Edition, 2013, John Wiley & Sons, New York.

Pharmaceutical Biochemistry-II

PHL-310
Cr. Hrs. 3

1. Vitamins

Chemistry, classification (fat-soluble and water-soluble vitamins), biological and pharmaceutical importance of vitamins.

2. Hormones

Chemistry, classification (proteinous and non-proteinous hormones, amino acid derivatives, steroids), biological and pharmaceutical importance of hormones.

3. Regulation of Metabolic Processes

Role of vitamins, physiological role of fat-soluble and water-soluble vitamins. Co-enzymes and their role in the regulation of metabolic processes. Niacin, thiamine, riboflavin, pyridoxine, pantothenic acid, biotin, folic acid and vitamin B12.

4. Receptor Mediated Regulation (Hormones)

Mechanism of action of hormones, physiological roles of various hormones, site of synthesis and target sites of hormones, action, regulation, signal transduction mechanism, role of cAMP, calcium ions and phosphoinositides, tyrosine kinase, JAK-kinase in the regulation of metabolic processes.

5. Gene Expression

Regulation of gene expression, chemistry, transcription and translation, introduction to biotechnology and genetic engineering. Basic principles of recombinant DNA technology, pharmaceutical applications. Genetic switch, inducers, fusion, genes, regulatory genes, zinc finger, helix-turn-helix motif, the leucine-zipper motif.

Books Recommended

1. Alisa Peet, Michael A. Lieberman, Allan Marks. Marks' Basic Medical Biochemistry. 4th edition, 2012, Lippincott Williams & Wilkins.
2. David L. Nelson, Michael M. Cox. Lehninger Principles of Biochemistry. 6th Edition, 2012, W.H. Freeman.
3. MN Chatterjee & Rana Shinde. Text book of medical biochemistry. 8th edition, 2011 Jaypee Publishers.
4. Pamela C. Champe & Richard A. Harvey. Lippincott's Illustrated Review: Biochemistry. 6th Edition, 2013, Lippincott Williams & Wilkins, Philadelphia.
5. Robert K. Murray. Harper's Illustrated Biochemistry. 30th Edition, 2015, Lange Medical Books, McGraw Hill, New York.

PHL – 314
Cr. Hrs. 2

Anatomy

1. Introduction

Anatomical terminology, definition of cell, tissue, organ, structure of cell membrane, cytoplasm, organelles, nucleus, cell cycle.

2. Tissues of Body

Cartilage, bone structure and types of bones and joints.

3. Muscle

Structure of skeletal, smooth muscles, and cardiac muscles.

4. Integumentary System

Including skin, glands, hair and nail.

5. Cardio Vascular System

Structure of heart, location, blood supply to heart, types of blood vessels.

6. Elementary System

Name and structure of different parts of elementary system and their interrelationship.

7. Urinary System

Name and structure of organs of urinary system and their inter relationship.

8. Male and Female Reproductive Systems

Endocrine system including pituitary, thyroid and adrenal glands with their structures.

9. Central Nervous System

Including neuron, organization of CNS, brain, cerebrum, cerebellum, brain stem, Pons and medulla oblongata, thalamus, hypothalamus, cranial nerves. Internal structure of spinal cord CSF, sensory and motor pathways, spinal reflexes, peripheral spinal nerves.

10. Autonomic Nervous System

Sympathetic and parasympathetic nervous system.

Books Recommended

1. Edith Applegate. The Anatomy and Physiology Learning System. 4th edition, 2010, Saunders.
2. Frederic H. Martini. Fundamentals of Anatomy and Physiology. 10th Edition, 2014, Prentice Hall, New Jersey.
3. Gerard J. Tortora & Bryan Derrickson. Principles of Anatomy and Physiology. 14th Edition, 2013, John Wiley & Sons, New York.
4. Richard L. Drake, A. Wayne Vogl, Adam W. M. Mitchell. Gray's Anatomy for Students. 3rd edition, 2014, Churchill Livingstone.
5. Kevin T. Patton, Gary A. Thibodeau. Anatomy & Physiology. 8th edition, 2013, Mosby.

Second Professional

Systemic Pharmacology - I

PHL-410
Cr. Hrs. 3

1. Autacoids and their Antagonists

Serotonin and serotonin antagonist, other autacoids; histamine and antihistamines, prostanoids.

2. Inflammatory Disorders

Medication for inflammatory disorders; uricosuric agents; glucocorticoids.

3. Drugs Acting on G.I.T. System

Gastroesophageal reflux disease and its treatment; emesis and antiemetics; constipation and laxatives. Diarrhea and antidiarrheals; peptic and duodenal ulcer, drugs used in their treatments; drugs for inflammatory bowel disease, and for cholelithiasis; prokinetics.

4. Chemotherapy

Introduction, principles of cell proliferation and chemotherapy. Principles of combination therapy, resistance of chemotherapy.

5. Chemotherapeutic Drugs

Antimicrobial, antiviral, antiprotozoal, antifungal, anthelmintic, antimycobacterial.

Books Recommended

1. Anthony Trevor, Bertram Katzung, Susan Masters, Marieke Knuidering-Hall. Katzung & Trevor's Pharmacology Examination and Board Review, 14th Edition, 2015. Lange Medical Books.
2. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.
3. David E. Golan, Armen H. Tashjian, Jr. Ehrin J. Armstrong, April W. Armstrong. Principles of Pharmacology "The Pathophysiologic Basis of Drug Therapy". 3rd Edition (2011). Lippincott Williams & Wilkins.
4. Goodman & Gilman's. The Pharmacological Basis of Therapeutics 12th Edition, 2010. McGraw-Hill, USA.
5. Rang H.P., Dale M.M. Rang & Dale's Pharmacology, 8th Edition, 2015. Churchill Living Stone, England.

Third Professional

Pharmacology (Practical)

PHL-510
Cr. Hrs. 3

1. Research methods and experimental techniques in pharmacology.
2. Development of experimental design and animal handling.
3. Routes of administration.
4. Preparation of physiological salt solutions.
5. To demonstrate the effects of sympathomimetic and sympatholytic drugs on frog's heart.
6. To demonstrate the effects of parasympathomimetic and parasympatholytic drugs on frog's heart.
7. To demonstrate the effects of an unknown drug on frog's heart
8. To demonstrate the effects of vasoconstrictor drugs on frog's blood vessels.
9. To demonstrate the effects of stimulant drugs on rabbit's intestine.
10. To demonstrate the effects of depressant drugs on rabbit's intestine.
11. To demonstrate the effects of an unknown drug on rabbit's intestine and identify the (unknown) drug.
12. To study the effects of adrenaline on rabbit's eyes.
13. To study the effects of homatropine on rabbit's eyes.
14. To study the effects of pilocarpine on rabbit's eyes.
15. To study the effects of local anesthetic drug.
16. To determine the analgesic response of the given drug.

Books Recommended

1. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.
2. Bikash M, Ajay P. Practical Manual of Experimental and Clinical Pharmacology. 1st edition, 2010, Jaypee Brothers Medical Publishers.
3. K.K. Pillai. Experimental Pharmacology. 2012, CBS Publisher.
4. Mark A. Suckow, Karla A. Stevens, Ronald P. Wilson. "The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents". 1st edition, 2012, Academic Press.
5. Richard A. Harvey, Michelle A Clark, Richard Finkel, Jose A. Rey , Karen Whalen . Pharmacology (Lippincott's Illustrated Reviews). 6th edition, 2014, Lippincott Williams & Wilkins.

Fourth Professional

Pharmacology (Practical)

PHL-612
Cr. Hrs. 3

1. To study the convulsant effect of strychnine and picrotoxin in frogs and to determine the site of action.
2. To observe the effect of drugs on gross behavioral changes of animal.
3. To observe the effect of drugs on exploratory behavior of mice.
4. To identify the unknown (convulsant) drug and determine its site of action.
5. To observe the anti-inflammatory effect of given drug by hind paw method.
6. To observe the effect of a diuretic in animal.
7. To observe the hypoglycemic effect of drugs in rabbit.
8. To identify and differentiate the effects of unknown drug on human and the nerve plexus of frog.

9. To demonstrate the effects of acetylcholine on the rectus abdominus muscle of frog and competitive pharmacological antagonism by Neuromuscular blocking agents.
10. To identify the unknown drug by performing pharmacological competitive antagonism on rectus abdominus muscle of frog.
11. To study the effects of heparin and oral anticoagulants on rabbits.
12. To identify the unknown anticoagulant drug using rabbits.
13. To identify unknown concentration of acetylcholine from graded dose-response curves.
14. To observe the effect of drug on swimming induced depression.
15. To observe the effects of drug on learning behavior of animal.

Books Recommended

1. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.
2. Bikash M, Ajay P. Practical Manual of Experimental and Clinical Pharmacology. 1st edition, 2010, Jaypee Brothers Medical Publishers.
3. K. K. Pillai. Experimental Pharmacology. 2012, CBS Publisher.
4. Mark A. Suckow, Karla A. Stevens, Ronald P. Wilson. "The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents". 1st edition, 2012, Academic Press.
5. Richard A. Harvey, Michelle A Clark, Richard Finkel, Jose A. Rey , Karen Whalen. Pharmacology (Lippincott's Illustrated Reviews). 6th edition, 2014, Lippincott Williams & Wilkins.

Fifth Professional

Toxicology

PHL-712
Cr. Hrs. 2

1. Principles of Toxicology

Principles of treatment of poisoning, classification of toxic agents, spectrum of undesired effects, mechanisms of toxicity.

2. Disposition of Toxicants

Absorption, distribution and elimination of toxicants, biotransformation of xenobiotics.

3. Target Organs of Toxicity

Toxic responses of the blood, toxic responses of the liver, toxic responses of the heart, toxic responses of the kidney, toxic responses of reproductive system.

4. Environmental Toxicology

Air pollution and ecotoxicology.

5. Applications of Toxicology

Food toxicology, forensic toxicology, clinical toxicology, occupational toxicology, risk assessment.

Books Recommended

1. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.

2. Curtis D. Klaassen. Casarett & Doull's Toxicology: The basic science of poisons. 8th Edition, 2013, McGraw Hill Medical Publishing Division, London.
3. Ernest Hodgson, Patricia E. Levi. A text book of modern toxicology. 4th edition. 2010. John Wiley & Sons. Inc.
4. Fank C. Lu and Sam Kacew. Lu's basic toxicology: Fundamentals, target organs and risk assessment, 6th Edition 2012, CRC Press.
5. Timbrell J.A. Introduction to Toxicology. 3rd edition, 2001, Taylor & Francis Ltd.

Pharm. D. (Deficiency) Courses

1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHL-711(D)	Clinical Pharmacology	3	PHL -712(D)	Toxicology	3
PHL -715(D)	Anatomy	2	PHL -718(D)	Physiology and Histology (Practical) Pharmaceutical Biochemistry (Practical)	3
PHL -721(D)	Pathology (Theory and Practical)	2+1			
Total 5 courses, making 14 Credit hours in one year.					

First Semester

Clinical Pharmacology

PHL-711(D)
Cr. Hrs. 3

1. Introduction to Clinical Pharmacology

Terminology, basic components and scope.

2. Role of Drug Monitoring in Therapeutics

Patient profile, diseases profile, drug profile, monitoring responses, monitoring plasma concentration.

3. Factors Affecting Drug Response

Pharmacogenetics, drug interactions.

4. Development of New Drugs

Process of drug development, preclinical studies, types of clinical trials, choice of patients, exclusion criteria of patients.

5. Drugs in Pregnancy

Prescribing in pregnancy, harmful effects on fetus. Pharmacokinetics in pregnancy.

6. Drugs in Infants and Children

Practical aspects of prescribing. Pharmacokinetics.

7. Drugs in Elderly

Pharmacokinetics changes. Pharmacodynamic changes.

8. Drug Toxicity

Adverse drug reactions. Monitoring adverse drug reactions, benefit risk ratio.

9. Pharmacology of Nutrients

Books Recommended

1. Arthur J. Atkinson Jr, Shiew-Mei Huang, Juan J.L. Lertora, Sanford P. Markey. Principles of Clinical Pharmacology. 3rd edition, 2012, Academic Press.
2. P.V. Rataboli. Clinical Pharmacology and Rational Therapeutics, 2nd edition, 2010, Ane Books Pvt Ltd.
3. Gerard A. McKay, Matthew R. Walters. Clinical Pharmacology and Therapeutics. 9th edition, 2013, Wiley Blackwell.
4. Mary Anne Koda Kimble. Koda-kimble & Young's Applied Therapeutics: "The Clinical Use of Drugs" 10th Edition, 2012. Lippincott Williams & Wilkins USA.
5. Roger Walker and Cate Whittlesea. Clinical Pharmacy and Therapeutics, 5th Edition (2011).

Anatomy

1. Introduction

Anatomical terminology, definition of cell, tissue, organ, structure of cell membrane, cytoplasm organelles, nucleus, cell cycle.

2. Tissues of Body

Cartilage, bone structure and types of bones and joints.

3. Muscle

Structure of skeletal, smooth muscles, and cardiac muscles.

4. Integumentary System

Including skin, glands, hair and nail.

5. Cardio Vascular System

Structure of heart, location, blood supply to heart, types of blood vessels.

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. Male and Female Reproductive Systems

Endocrine system including pituitary, thyroid and adrenal glands with their structures.

9. Nervous System

Including neuron, organization of CNS, brain, cerebrum, cerebellum, brain stem, pons and medulla oblongata, thalamus, hypothalamus, cranial nerves. Internal structure of spinal cord CSF, sensory and motor pathways, spinal reflexes, peripheral spinal nerves.

10. Autonomic Nervous System

Sympathetic and parasympathetic nervous system.

Books Recommended

1. Edith Applegate. The Anatomy and Physiology Learning System. 4th edition, 2010, Saunders.
2. Frederic H. Martini. Fundamentals of Anatomy and Physiology. 10th Edition, 2014, Prentice Hall, New Jersey.
3. Gerard J. Tortora & Bryan Derrickson. Principles of Anatomy and Physiology. 14th Edition, 2013, John Wiley & Sons, New York.
4. Richard L. Drake, A. Wayne Vogl, Adam W. M. Mitchell. Gray's Anatomy for Students. 3rd edition, 2014, Churchill Livingstone.
5. Kevin T. Patton , Gary A. Thibodeau . Anatomy & Physiology. 8th edition, 2013, Mosby.

Pathology (Theory + Practical)

PHL-721(D)
Cr. Hrs. 2+1

1. Scope of Pathology and Concept of Diseases

2. Definition and Terminology

Ischemia	.....	Hypoxia
Necrosis	.....	Infarction
Atrophy	.....	Hypertrophy
Hyperplasia	.....	Metaplasia
Aplasia	.....	Anaplasia

3. Response of Body to Injury and Infection

Acute inflammation, chronic inflammation, immunity, allergy and hypersensitivity.

4. Specific Diseases

Peptic and duodenal ulcer, hypertension, leukaemia or blood cancer, malignant carcinoma, sarcoma and lymphomas.

5. Diagnosis and Treatment of Cancer

Fate, survival and prognosis of tumors.

Pathology (Practical)

1. Study of Pathological Slides of Various Pathological Conditions

Acute inflammation, chronic inflammation, chronic specific inflammation, different types of degeneration, thrombosis, embolism, infarction, necrosis, gangrene, hyperplasia, metaplasia, pigmentation, calcification, C.V.C., papilloma, adenoma, chondroma, fibroma, leiomyoma, neofibroma, Squamous cell carcinoma, basal cell carcinoma, transitional cell carcinoma, adenocarcinoma, fibrocarcinoma, rhabdomyosarcoma, leiomyosarcoma, lymphosarcoma, liposarcoma, reticular cell sarcoma, Hodgkin's disease, breast carcinoma, osteogenic, sarcoma, osteoclastoma.

2. Examination of Different Body Fluids in Various Pathological Conditions

Urine complete examination, stool examination, blood complete examination, semen examination, cerebrospinal fluid examination, pericardial fluid examination, pleural fluid examination, aseptic fluid examination, blood sugar, blood urea, blood cholesterol etc.

3. Tests for Various Specimens of Clinical Importance

Techniques of clinical blood examination for various diseases, gastric analysis, tests for liver function test, renal function test, test for endocrine abnormalities, biopsies and cytological techniques.

Books Recommended

1. David E. Golan, Armen H. Tashjian, Jr, Ehrin J. Armstrong, April W. Armstrong. Principles of Pharmacology. "The Pathophysiologic Basis of Drug Therapy". 3rd Edition (2011).
2. Martin Gwent Lewis and Thomas K. Barton. Appleton & Lange's Review of General Pathology. 4rd Edition, 2002, Prentice Hall International Inc.
3. Ramzi S. Cotran, Vinay Kumar & Stanley L. Robbins. Robbins & Cotran Pathologic Basis of Disease. 9th Edition, 2014. W.B. Saunders Company, Philadelphia.
4. Russell J. Greene and Norman D. Harris. Pathology and Therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice. 3rd edition, 2008. Chapman & Hall, London.
5. Stephen J. McPhee, Maxine Papadakis, Lawrence M. Tierney . Current Medical Diagnosis and Treatment, 54th Edition, 2015, Lange Medical Books, McGraw-Hill Medical Publishing Division, London.

Second Semester

Toxicology

PHL-712(D)
Cr. Hrs. 3

1. Principles of Toxicology

Principles of treatment of poisoning, classification of toxic agents, spectrum of undesired effects, mechanisms of toxicity, risk assessment.

2. Disposition of Toxicants

Absorption, distribution and elimination of toxicants, biotransformation of xenobiotics, toxicokinetics.

3. Target Organs of Toxicity

Toxic responses of the blood, toxic responses of the liver, toxic responses of the heart, toxic responses of the kidney, toxic responses of reproductive system.

4. Environmental Toxicology

Air pollution, ecotoxicology, toxic effects of plants.

5. Application of Toxicology

Food toxicology, forensic toxicology, clinical toxicology, occupational toxicology.

Books Recommended

1. Bertram G. Katzung, Susan Masters, Anthony Trevor. Basic and Clinical Pharmacology, 13th Edition, 2014. A Lange Medical Book. London.
2. Curtis D. Klaassen. Casarett & Doull's Toxicology: The basic science of poisons. 8th Edition, 2013, McGraw Hill Medical Publishing Division, London.
3. Ernest Hodgson, Patricia E. Levi. A text book of modern toxicology. 4th edition. 2010. John Wiley & Sons Inc.
4. Fank C. Lu and Sam Kacew. Lu's basic toxicology: fundamentals, target organs and risk assessment, 6th Edition 2012, CRC Press.
5. Timbrell J.A. Introduction to Toxicology. 3rd edition, 2001, Taylor & Francis Ltd.

Physiology and Histology (Practical) Pharmaceutical Biochemistry (Practical)

PHL-718(D)
Cr. Hrs. 2+1

1. Introduction Experimental Physiology

2. Blood

Determination of haemoglobin, determination of ESR, RBC count, WBC count, differential leucocyte count, bleeding and clotting time, blood groups.

3. Respiration

Estimation of vital capacity and its relation to posture and standard vital capacity, determination of tidal volume, demonstration of artificial respiration.

4. C.V.S

Recording of arterial pulse, recording of arterial B.P.

5. Eye

Visual acuity, far vision, near vision and field of vision.

6. C.N.S

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

7. Histology

Demonstration, preparation and staining of the slides, histological examination of slides, epithelium, connective tissue, muscle tissue, organ –system –lungs, kidney, appendix, skin, gall–bladder, stomach, intestine.

8. Qualitative Analysis

Carbohydrates. amino acids, peptides and proteins. Lipids and sterols (cholesterol) bile salts and bilirubin. Blood analysis-sugar, uric acid, bilirubin, cholesterol and creatinine.

9. Quantitative Analysis

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, bilirubin, cholesterol and creatinine.

Books Recommended

1. Arthur C. Guyton and John E. Hall. Textbook of Medical Physiology. 13th Edition 2015 W.B. Saunders, Philadelphia.
2. Douglas F. Paulsen. Basic Histology: Examination and Board Review. 5th edition, 2010. Prentice Hall Internal Inc.
3. Gerard J. Tortora & Sandra Reynold Grabowski. Principles of Anatomy and Physiology. 14th Edition, 2013, John Willey & Sons, New York.
4. Pamela C. Champe & Richard A. Harvey. Lippincott's Illustrated Review: Biochemistry. 6th Edition, 2013, Lippincott Williams & Wilkins, Philadelphia.
5. Robert K. Murray. Harper's Illustrated Biochemistry. 30th Edition, 2015, Lange Medical Books, McGraw Hill, New York.



Department of
Pharmacognosy



Pharmacognosy derives its origin from two Greek words, *pharmakon* meaning drug, and *gnosis* meaning knowledge. It is the study of natural bioactive substances obtained from terrestrial and marine plants, animals, microbes and minerals for their physical, chemical, biochemical and biological properties, their taxonomy and ethnobiology. Pharmacognosy is one of the major areas of pharmaceutical sciences; today is a highly interdisciplinary science, linked to phytochemistry, microbial chemistry, biosynthesis, biotransformation, chemotaxonomy, biotechnology and other biological and chemical sciences. Research in Pharmacognosy provides for the discovery of lead compounds for drug development, new methods of analysis for drugs, toxins and herbal preparations.

The objective of the Department of Pharmacognosy is to educate students about the natural source of drugs, their pharmacognostic and phytopharmacological

attributes, chemical and spectroscopic profile of isolated molecules and their development as modern pharmaceutical products.

“Then eat from all the fruits and follow the ways of your Lord laid down [for you]. There emerges from their bellies a drink (honey), varying in colors, in which there is healing for people. Indeed, in that is a sign for a people who give thought.” (Sūrah-An-Nahl (The Bees): verse (69)

The Prophet Muhammad (PBUH) said, “Make use of the two cures: honey and the Qur’an”. [Ibn Majah and others]

Hazrat Abu Hurairah States – “I have heard from Rasool Allah (PBUH) that there is cure for every disease in black seeds except death and black seeds are Shooneez.”

Hippocrates, the father of modern medicine, 2,500 years ago said “Let food be thy medicine and medicine be thy food”.

Faculty

Pharmacognosy



Dr. Iqbal Azhar

Professor and Chairperson

Qualification

**Ph.D., M. Pharm., B. Pharm.
(University of Karachi)**

Year of Association
1994

Subjects of Interest

Natural Products

Area of Research Interest

**Nutraceuticals, Cosmeceuticals,
Phytopharmaceuticals**

Email

iqbal_zhr@yahoo.com

Phone Number

(+92-21)99261300-7 Ext. 2202



**Dr. Muhammad
Mohtasheemul Hasan**

Associate Professor

Qualification

**Ph.D., M. Phil., B. Pharm.
(University of Karachi)**

Year of Association
2006

Subjects of Interest

Pharmacognosy / Pharmaceutical Biology

Area of Research Interest

Phytopharmacology, Phytochemistry

Email

mohassan@uok.edu.pk

Phone Number

(+92-21)99261300-7 Ext. 2202



Ms. Farah Mazhar

Assistant Professor

Qualification

**M. Phil., B. Pharm.
(University of Karachi)**

Year of Association
2000

Subjects of Interest

Pharmacognosy, Natural Products

Area of Research Interest

**Pharmacognosy, Terrestrial and Marine
Natural Products, Evaluation and
Standardization of Herbal Drugs,
Bioassays**

Email

famazhar@uok.edu.pk

Phone Number

(+92-21)99261300-7 Ext. 2202

Faculty

Pharmacognosy



**Dr. Maryam
Ahmed**

Assistant Professor

Qualification

Ph.D., M. Pharm., B. Pharm.
(University of Karachi)

Year of Association

2018

Subjects of Interest

Pharmacognosy, Natural Products

Area of Research Interest

**Phytomedicine, Phytochemical,
Nutraceutical, Phytopharmaceutical,
Phytopharmacology**

Email

dr.maryamahmd@gmail.com

Phone Number

(+92-21)99261300-7 Ext. 2202



Dr. Safia Abidi

Assistant Professor

Qualification

Ph. D., M. Pharm., B. Pharm.
(University of Karachi)

Year of Association

2013

Subjects of Interest

Pharmacognosy

Area of Research Interest

Natural Products

Email

safiaabidi@yahoo.com

Phone Number

(+92-21)99261300-7 Ext. 2202



**Dr. Salman
Ahmed**

Assistant Professor

Qualification

Ph. D., M.Phil., B. Pharm.
(University of Karachi)

Year of Association

2013

Subjects of Interest

Pharmacognosy

Area of Research Interest

**Phytomedicine, Phytopharmacology,
Medicinal Plants**

Email

salmanahmed@uok.edu.pk

Phone Number

(+92-21)99261300-7 Ext. 2202

Board of Studies

Dr. Iqbal Azhar

Professor and Chairperson

Dr. Muhammad Mohtasheemul Hasan

Associate Professor

Dr. Safia Abidi

Assistant Professor

Dr. Izhar M. Hussein

Director,

Institute of Health and Management Sciences,
Dow University of Health Sciences, Karachi.

Prof. Dr. Syed Waseemuddin Ahmed

Dean, Faculty of Pharmacy,
Benazir Bhutto Shaheed University,
Lyari, Karachi.

Dr. Zafar Alam Mehmood

Country Manager,
Colorcon Limited-UK.
England Subsidiary of Brewing Pharmaceutical Inc.
Dartford, Kent, UK.

Prof. Dr. Huma Sharif

Institute of Pharmaceutical Sciences,
Jinnah Sindh Medical University,
Karachi.

Pharm. D. Courses

First Professional					
1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
-	-		PHG-312	General Pharmacognosy	3
Second Professional					
PHG-411	Herbal Quality Control Lab-I	3	PHG-412	Chemical Pharmacognosy - I	3
Third Professional					
PHG-511	Chemical Pharmacognosy - II	3	PHG-512	Herbal Quality Control Lab - II	3
-	-		PHG-514	Natural Toxins	2
Fourth Professional					
PHG-611	Advance Pharmacognosy	3	-	-	-
Fifth Professional					
PHG-713	Clinical Pharmacognosy	2	-	-	-
Total of 8 courses comprising 22 credit hours, distributed over five years.					

English compulsory course is taught in 1st year (second semester) as a non-credit course, under the Department of Pharmacognosy.

First Semester Second Professional

Herbal Quality Control Lab-I

PHG-411
Cr. Hrs. 3

1. **Physical Methods**
 - a. **Macroscopic / Organoleptic Evaluation**

Plant Drugs Organized Drugs

Seed: *Cucumis melo, Datura stramonium, Lallementia royleana, Nigella sativa, Psoralea corylifolia, Ricinus communis, Strychnos nux-vomica*

Fruit: *Aegle marmelos, Cassia fistula, Ficus carica, Phycotis ajowan, Terminalia chebula, Tribulus terrestris*

Pod:	<i>Cassia fistula, Helicteres isora, Moringa olifera, Papaver somniferum</i>
Flower:	<i>Catharanthus roseus, Hibiscus rosa-sinensis, Moringa olifera, Onosma bracteatum, Punica granatum, Viola odorata</i>
Leaf:	<i>Catharanthus roseus, Cinnamomum zeylanicum, Cordia myxa, Gymnema sylvestre, Lawsonia innermis, Ocimum tenuiflorum, Onosma bracteatum</i>
Bark:	<i>Acacia nilotica, Azadirachta indica, Cinnamomum zeylanicum, Onosma echinoides, Valeriana hardwickii, Saraca indica, Prosopis juliflora</i>
Root:	<i>Glycyrrhiza glabra, Valeriana officinalis</i>
Rhizome:	<i>Alpinia officinarium, Curcuma amada, Curcuma longa, Smilax china, Zingiber officinale</i>

Unorganized Drugs

Extracts:	<i>Aloe indica, Uncaria gambir, Rhus toxicodendron</i>
Exudates:	<i>Acacia arabica, Bambusa arundinacea, Ferula foetida, Styra benzoin</i>

Animal Drugs

Apis mellifera, Bombyx mori, Cantheris vesicatoria, Cervus elephus, Laccifer lacca, Ovis aries

Mineral Drugs

Alum, Borax, Sulphur, Ammonium chloride, Asphalt, Magnesium salts, Aluminium hydroxide, Sodium bicarbonate.

b. Microscopic Evaluation

Section Cutting

Transverse sections of the following crude drugs:

Stem:	<i>Ephedra sinica, Santalum album, Tinospora cordifolia</i>
Leaf:	<i>Cassia senna, Eucalyptus globulus, Mentha piperita</i>
Fruit:	<i>Piper nigrum, Foeniculum vulgare</i>
Seed:	<i>Myristica fragrans, Ricinus communis, Strychnos nux-vomica</i>
Bark:	<i>Azadirachta indica, Cinnamomum zeylanicum, Saraca indica</i>
Root:	<i>Glycyrrhiza glabra, Rauwolfia serpentina</i>
Rhizome:	<i>Curcuma longa, Zingiber officinale</i>
Flower Bud:	<i>Eugenia caryophyllus</i>

Powder Microscopy

Powder microscopy of the following crude drugs

Bark:	<i>Acacia nilotica, Azadirachta indica, Cinnamomum zeylanicum</i>
Seed:	<i>Hyocyamus niger, Strychnos nux-vomica, Trigonella foenum-graecum</i>
Flower:	<i>Eugenia caryophyllus, Matricaria chamomilla, Punica granatum</i>
Leaf:	<i>Cassia senna, Lawsonia innermis, Mentha piperita</i>
Fruit:	<i>Coriandrum sativum, Foeniculum vulgare, Illicium verum</i>
Root:	<i>Glycyrrhiza glabra, Rauwolfia serpentina, Valeriana officinalis</i>
Rhizome:	<i>Alpinia officinarium, Curcuma longa, Zingiber officinale</i>

c. Determination of stomatal index, Palisade ratio and type of stomata

Determine the stomatal index, Palisade ratio and type of stomata of the following leaf drugs:

Leaf: *Cassia senna, Eucalyptus globulus, Mentha piperita*

d. Determination of Foreign Matter, Moisture Content, Extractive Value, Ash Values

Determine the foreign matter, moisture content, extractive value and ash value of the following drugs:

Cassia senna leaf, *Glycyrrhiza glabra* root, *Trigonella foenum-graecum* seeds

2. Biological Testing

a. Determination of Swelling Index

Determine the swelling index of the following seed drugs:

Triognella foenum-graecum, Lallelantia royleana, Plantago ovata, Linum usitatissimum

b. Determination of Foaming Index

Determine the foaming index of the following drugs:

Sapindus trifoliatius (fruit), *Triognella foenum-graecum* (seed), *Ziziphus mauritiana* (fruit), *Medicago sativa* (leaves), *Glycyrrhiza glabra* (root), *Smilax china* (rhizome).

Books Recommended

1. Fundamentals of Pharmacognosy and Phytotherapy,(3rd ed.), Michael Heinrich, Elizabeth M. Williamson, Simon Gibbons, Joanne Barnes, Jose Prieto-Garcia, Elsevier Health Sciences, (2018).
2. Pharmacognosy: Fundamentals, Applications and Strategies, (1st ed.), Rupika Delgoda (Author), Simone Badal Mccreath (Ed.) Academic Press, (2016).
3. Practical Pharmacognosy, Rasheeduz Zafar, Neerja Gandhi, CBS Publishers & Distributors (2021).
4. Practical Pharmacognosy, S.B Gokhale, Dr. C.K. Kokate, Ali, Nirali Prakashan (2008).
5. Powdered Crude Drug Microscopy of Leaves and Barks, Vidhu Aeri, D.B. Anantha Narayana, Dharya Singh, Elsevier Science (2019).
6. Encyclopedia of World Medicinal Plants (vol. 5), T. Pullaiah, Illustrated, Regency Publications, New Delhi (2006).
7. Drugs of Natural Origin: A Treatise of Pharmacognosy, (7th ed.), Gunnar Samuelsson, Lars Bohlin, Swedish Pharmaceutical Press (2015).
8. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals (1st ed.), Pulok K. Mukherjee, Publisher Business Horizons, New Delhi (2002).
9. Adulteration in Herbal Drugs: A Burning Issue, Shabnum Shaheen, Sehrish Ramzan, Farah Khan, Mushtaq Ahmad, Springer Nature (2019).

Third Professional

Chemical Pharmacognosy-II

**PHG-511
Cr. Hrs. 3**

1. Alkaloids

Introduction, classification, biosynthesis, extraction and isolation of alkaloids. Sources, physical features, chemical composition, medicinal and pharmaceutical uses of Pyridine (*Nicotiana tabacum*), Piperidine (*Nicotiana tabacum*), Tropane (*Hyocyamus, Atropa, Datura stramonium*), Imidazole (*Pilocarpus microphyllus*), Isoquinoline (*Cephalis ipecacuanha*,

Chondrodendron tomentosum, *Papaver somniferum*), Quinoline (*Cinchona succirubra*), Indole (*Claviceps purpurea*, *Rauwolfia serpentina*, *Catharanthus roseus*, *Strychnos nux-vomica*), Purine (*Thea sinensis*), Steroidal (*Veratrum viride*), Diterpene (*Aconitum napellus*), Phenethylamine (*Ephedra sinica*, *Colchicum autumnale*) alkaloids.

2. Glycosides

Introduction, classification, biosynthesis, extraction and isolation of glycosides. Sources, physical features, chemical composition, medicinal and pharmaceutical uses of glycosides from *Cascara sagrada*, *Cassia senna*, *Aloe barbadensis* (anthraquinone glycosides); *Ginkgo biloba* (flavonoid glycosides); *Dioscorea spp.*, *Smilax spp.* (steroidal saponin); *Glycyrrhiza glabra* (flavonoid glycosides, triterpenoidal saponins); *Panax ginseng* (steroid glycosides, triterpenoidal saponins).

3. Methods of Extraction and Isolation of Natural Products

Introduction to extraction, mechanism and factors affecting extraction. Methods of extraction, their advantages and disadvantages. Classic methods: infusion, decoction, percolation, maceration, digestion, distillation; Modern methods: supercritical fluid extraction method, continuous hot extraction, soxhlet extraction, counter current extraction, microwave assisted extraction, ultrasonication assisted extraction, enzyme assisted extraction, pressurized liquid extraction.

Methods of Purification: crystallization, sublimation, distillation, precipitation, chromatography.

4. Chromatography

Introduction and modes of chromatography: adsorption, partition, size exclusion, ion-exchange, affinity. Types of chromatography: column chromatography, thin layer chromatography, paper chromatography, LC-MS, droplet counter current chromatography, HPLC, gas chromatography, ion-exchange, size exclusion and affinity chromatography, their assembly/Instrumentation, methodology, principle of separation and application. for the separation, isolation, purification and identification of natural products.

5. Characterization of Natural Products

Characterization of natural products by spectroscopic techniques (Atomic absorption, Circular dichroism, FTIR, IR, Mass, NMR, UV, UV/Vis, X-ray spectroscopy and hyphenated techniques.

Books Recommended

1. Biosynthesis of Natural Products, Mannito P., John Wiley and Sons, New York (1981).
2. Herbal Drugs and Phytopharmaceuticals, Norman G. Bisset (Ed.), Medpharm
3. Scientific Publishers, Stuttgart (1994).
4. Medicinal Natural Products: A Biosynthetic Approach (3rd ed.), Paul M Dewick, John Wiley and Sons, Ltd., Chichester (2009).
5. Medicinal Plants of the World: Chemical Constituents, Traditional and Modern Medicinal Uses (vol. 1-3), Ivan A. Ross, Humana Press, New Jersey (2005).
6. Fundamentals of Pharmacognosy and Phytotherapy (3rd ed.), Michael Heinrich, Elizabeth M. Williamson, Simon Gibbons, Joanne Barnes, Jose Prieto-Garcia, Elsevier Health Sciences (2018).
7. Understanding Medicinal Plants: Their Chemistry and Therapeutic Action (1st ed.) Bryan Hanson, Routledge (2005).
8. Pharmacognosy: Fundamentals, Applications and Strategies (1st ed.), Rupika Delgoda (Author), Simone Badal McCreath (Ed.) Academic Press (2016).
9. Green Extraction of Natural Products: Theory and Practice, (1st ed.), Farid Chemat, Jochen Strube (Eds.) Wiley-VCH (2015).
10. Natural Products Isolation (Methods in Molecular Biology, 864), (3rd ed.), Satyajit D. Sarker, Lutfun Nahar (Eds.), Springer, 2012.
11. Plant-derived Bioactives: Chemistry and Mode of Action (1st ed.), Mallappa Kumara Swamy (Ed.), Springer (2020).
12. Chromatography: Concepts and Contrasts (2nd ed.), James M. Miller, Wiley-Interscience (2009).

Fourth Professional

Advance Pharmacognosy

PHG-611
Cr. Hrs. 3

1. Allergens and Allergenic Preparations

Introduction, atopy, types of hypersensitivity, classification of allergens, causes, history, Allergy tests (allergy skin testing, blood tests, spirometry, food challenges, drug/medication challenge, aspirin desensitization, patch testing), treatment of allergies (antihistamines, decongestants, nasal steroids, asthma medicines and immunotherapy) and method of preparation of allergy vaccines. Types of allergens on the basis of contact site: inhalant, ingestant, injectant, contactant, infectant and infestant.

2. Enzymes

Introduction, classification, chemistry and functions of plant, animal and microbial enzymes; pharmaceutical, therapeutic and diagnostic importance of enzymes. Study source and uses of L-arginase, asparaginase, bromelains, chymopapain, collagenase, fibrinolysin, glucosidase, hyaluronidase, β -lactamase, papain, pancreatin, pepsin, malt extract, streptokinase, superoxide dismutase, trypsin, urokinase.

3. Anticancer, Anti-AIDS, Immunomodulators

Introduction to anticancer agents of natural origin: *Catharanthus roseus*, *Colchicum autumnale*, *Podophyllum peltatum*, *Taxus brevifolia*, anthracyclines (daunorubicin, doxorubicin), bleomycin, dactinomycin, mitomycin c, macrolide antibiotics (erythromycin, clarithromycin).

Potential anti-AIDS agents: alkaloid (castanospermine), anthraquinone (hypericin), coumarins (calanolides A and B), dimeric sesquiterpene (gossypol), flavonoids (glycyrrhizoflavone, isolicoflavonol, licochalcone), pentacyclic triterpene (glycyrrhizin), tannins (tetragalloylquinic acid).

Potential immunomodulators: capsaicinoid (capsaicin), diarylheptanoid (curcumin), diterpene lactone (andrographolide), flavonols (epigallocatechin-3-gallate, quercetin), isoflavones (genistein), phenethylisoquinoline (colchicine), stilbenes (resveratrol).

4. Hormones

Introduction, chemical classification, commercial production, extraction and isolation of animal hormones. Therapeutic/ medicinal value of peptide and amino acid derivatives: adrenaline, nor adrenaline (adrenal gland), thyroxine, triiodothyronine, calcitonin (thyroid), vasopressin, oxytocin (pituitary), parathyroid hormone (parathyroid), insulin, glucagon (pancreas); Steroidal hormones: glucocorticoids, mineralocorticoids (adrenal gland), ovaries (progestogens, estrogens), testes (androgens).

Plant hormones: auxins, gibberellin, cytokinins, abscisic acid and their significance in the development of plants and their secondary metabolites.

5. Nutraceuticals

Introduction, classification, regulatory and market aspects of nutraceuticals. Source, chemistry, toxicity, side effects, role in healthcare system of the: cranberry extract, chitosan, chlorella, chondroitin, co-enzyme Q, flavonoids, flax seed oil, fluoride, garlic, isoflavones, kelp, lecithin, lignans, lycopen, pre- and pro- biotics, phytoestrogens, royal jelly, selenium, spirulina and zinc as nutraceuticals.

6. Cosmeceuticals

Introduction, classification of cosmeceuticals as skin, eye, hair care and others products. Natural source, isolated products, chemistry, uses, toxicity and the use in cosmeceuticals based on aloe, apricot, argan oil, arnica, balsam, bromelain,

calendula, chamomile, coconut, cucumber, henna, honey, jojoba, lavender, myrrh, oats, pomegranate, propolis, rosemary, tea, turmeric and walnut.

Books Recommended

1. Williams Textbook of Endocrinology (11th ed.), Henry Kronenberg, Shlomo Melmed, Kenneth Polonsky, Saunders (2008).
2. Anticancer Agents from Natural Products, Gordon M. Cragg, David G. I. Kingston, David J. Newman, CRC Press (2005).
3. Nutraceuticals: A Guide for Healthcare Professionals (2nd ed.). Brain Lockwood, Pharmaceutical Press, London (2007).
4. Cosmeceuticals and Active Cosmetics: Drugs versus Cosmetics, Peter Elsner and Howard I. Maibach (Eds.), CRC Press (2005).
5. Plants in Cosmetics: Plants and Plant Preparations used as Ingredients for Cosmetic Products, Anton R., Patri F. Silano V., Council of Europe Publishing (2001).
6. Research Advancements in Pharmaceutical, Nutritional, and Industrial Enzymology (1st ed.), Shashi Lata Bharati, Pankaj Kumar Chaurasia, IGI Global (2018).
7. Directory of Therapeutic Enzymes, (1st ed.), Barry M. McGrath, Gary Walsh, CRC Press, Boca Raton (2005).
8. Herbal Biomolecules in Healthcare Applications (1st ed.), Subhash C. Mandal, Amit Kumar Nayak, Amal Kumar Dhara, Academic Press (2021).
9. Handbook of Nutraceuticals and Functional Foods (3rd ed.), Robert E.C. Wildman, Richard S. Bruno (Eds.), CRC Press (2019).
10. Functional Foods and Nutraceuticals: Bioactive Components, Formulations and Innovations, (1st ed.), Chukwuebuka Egbuna, Genevieve Dable Tupas (Eds.), Springer (2020).
11. Cosmeceuticals, Y Madhusudan Rao, Shayeda, BS Publications (2012).

Fifth Professional

Clinical Pharmacognosy

PHG-713
Cr. Hrs. 2

1. Introduction to Clinical Pharmacognosy

Introduction and historical background of Clinical Pharmacognosy. Study of causes, pathogenesis, clinical features (sign and symptoms), diagnosis, prognosis, prevention and epidemiology of chronic diseases; principles of medication; treatment of diseases by herbal medicines.

2. Clinical Use of Herbal Medicine

CNS disorders

Atropa belladonna, Cannabis sativa, Datura stramonium, Hypericum perforatum, Papaver somniferum, Strychnos nux-vomica.

Cardiovascular diseases

Allium sativum, Crataegus monogyna, Convallaria majalis, Digitalis purpurea, D. lanata, Punica granatum, Urgenia indica.

Hepatic disorders

Berberis vulgaris, Chelidonium majus, Lawsonia inermis, Picrorhiza kurroa, Silybum marianum

Renal disorders

Berberis vulgaris, Cucumis melo, Serenoa repens, Tribulus terrestris, Urtica dioica, Zea mays

Pulmonary diseases

Adhatoda vasica, Althaea officinalis, Andrographis paniculate, Eucalyptus globulus, Ficus religiosa.

G.I.T. disorders

Aegle marmelos, Cuminum cyminum, Ferula foetida, Foeniculum vulgare, Mentha piperita, Prunus domestica.

Metabolic disorder: Diabetes

Caesalpinia bonducella, Galega officinalis, Gymnema sylvestre, Melia azadirchta, Momordica charantia, Syzygium jambulana.

Musculo-skeletal disorders

Ananas comosus, Capsicum annum, Curcuma longa, Nigella sativa, Phycotiss ajowan, Rosemarinus officinalis, Trigonella foenum-graecum, Zingiber officinale.

Reproductive disorders

Angelica polymorpha Maxim. var. Sinensis, Claviceps purpurea, Glycyrrhiza glabra, Myristica fragrans, Nigella sativa, Ruta graveolens, Saraca indica.

Dermal disorders

Aloe vera, Angelica archangelica, Argania spinosa, Citrus spp., Commiphora mukul, Melaleuca alternifolia, Mentha piperita.

Books Recommended

1. Evidence Based Validation of Traditional Medicines- A Comprehensive Approach (1st ed.), Subhash C. Mandal Raja Chakraborty, Saikat Sen, Springer Singapore (2021).
2. Herbal Biomolecules in Healthcare Applications, (1st ed.), Subhash C. Mandal, Amit Kumar Nayak, Amal Kumar Dhara, Academic Press (2021).
3. Pharmacognosy: Current Herbal Medications and Natural Product Chemistry for a PharmD Curriculum, Yan Zhang, Cognella Academic Publishing (2020).
4. Principle and Practice of Phytotherapy: Modern Herbal Medicine, Kerry Bone, Simons Mills, Churchill Livingstone (2013).
5. Pharmacological Methods in Phytotherapy Research, Selection, Preparation and Pharmacological Evaluation of Plant Material (vol.1), Elizabeth M. Williamson, David T. Okpako, Fred J. Evans, Wiley Publishers (1996).
6. Encyclopedia of World Medicinal Plants (vol. 5), T-Pullaiah., Regency Publication, New Delhi (2006).
7. Natural Products: Drug Discovery and Therapeutic Medicine, Lixin Zhang, Arnold L. Demain (Eds.), Humana Press (2005).
8. Handbook of Clinical Pharmacy, Dr. A. V. Yadav, B.V. Yadav, T. I. Shaikh, Nirali Parkashan, Pune (2008).
9. Drugs of Natural Origin , A Treatise of Pharmacognosy (7th ed.), Gunnar Samuelsson, Lars Bohlin, Swedish Pharmaceutical Press (2015).
10. Rational Phytotherapy: A Physicians' Guide to Herbal Medicine, (3rd ed.), Schulz V, Hänsel R, Tyler VE, Springer-Verlag (1996).

Second Semester First Professional

General Pharmacognosy

PHG-312

Cr. Hrs. 3

1. **Historical Development and Scope of Pharmacognosy in Modern Medicine**
Introduction and history of Pharmacognosy with special reference to the contribution of Muslim scientists (Hunayn bin Ishaq, Ali Ibn Sahl at-Tabari, Al-Razi, Al-Biruni, Ibn Sina, Ibn al-Baitar, Al-Nafis, Al-Idrisi, Al-Kindi) to the profession of Pharmacy.

Introduction to herbal pharmacopoeias and prospects of Pharmacognosy in modern medicine, Complementary and Alternative Medicine (CAM).

2. Crude Drugs

Introduction to crude drugs, classifications of crude drugs: alphabetical, morphological, taxonomical, chemical and therapeutic classification, their preparation and commerce. Official and un-official drugs.

3. Drugs of Natural Origin

Plant Drugs: Source, chemical nature, medicinal and pharmaceutical uses of *Ephedra sinica*, *Glycyrrhiza glabra*, *Cassia angustifolia*, *Laminaria spp.*, *Sargassum spp.*,

Animal drugs: Source, chemical nature and medicinal/ pharmaceutical uses of honey, gelatin, shellac, musk, civet, ambergris, cod liver oil, cantharides and spermaceti.

Mineral drugs: Sulphur, Alum, Borax, Magnesium salts, Aluminium hydroxide, Sodium bicarbonate.

Natural Fibers: Sources, classification of fibers as vegetable, animals and mineral fibers and their identification tests. Source, chemical nature and uses of cotton, wool, cellulose and catgut.

4. Biologics

Introduction to biologics and their types: vaccines, blood and its components, antisera, toxins, antitoxins, venoms, antivenins, cells, allergens, genes, tissues, and recombinant protein.

Types of Vaccines: Live-attenuated, inactivated, subunit, recombinant, polysaccharide and conjugated.

Preparation and uses of: tuberculosis, poliomyelitis, diphtheria, tetanus, pertussis, hepatitis B, haemophilus influenzae type b (Hib), pneumonia, meningitis, measles mumps and rubella (MMR), diarrhea, chicken pox, herpes zoster, human papillomavirus (HPV), rabies, typhoid, Covid-19 vaccines, toxins, antitoxins, venoms, antivenins, antisera.

The Expanded Program on Immunization (EPI) in Pakistan.

5. Quality Control and Standardization of Plant Drugs

Introduction to quality control and standardization of plant drugs. Difference between standardized crude drug and standardized crude extract. Types of quality control methods: physical, chemical and biological. Types of adulteration, inferiority, spoilage, admixture, sophistication and substitution of crude drugs. WHO guidelines for standardization of plant drugs and its significance.

Books Recommended

1. Trease and Evans' Pharmacognosy (16th ed.), William C. Evans, George E. Trease, Daphne Evans, Elsevier (2009).
2. Fundamentals of Pharmacognosy and Phytotherapy (3rd ed.), Michael Heinrich, Elizabeth M. Williamson, Simon Gibbons, Joanne Barnes, Jose Prieto-Garcia, Elsevier Health Sciences (2018).
3. Remington: The Science and Practice of Pharmacy (Remington: The Science and Practice of Pharmacy (23rd ed.), Adeboye Adejare (Ed.), Academic Press; (2020).
4. Pharmacognosy: Fundamentals, Applications and Strategies (1st ed.), Rupika Delgoda (Author), Simone Badal McCreath (Ed.) Academic Press, (2016).
5. Pharmacognosy (9th ed.), Tyler V.E., Brady L.R. and Robbers J.E., Lea and Febiger, Philadelphia (1988).
6. ABC of Complementary Medicine. Volume 92 of ABC Series (2nd ed.), Catherine Zollman, Andrew J. Vickers, Janet Richardson (Eds.), John Wiley & Sons (2009).
7. Dictionary of Natural Products: Terms in the Field of Pharmacognosy Relating to Natural Medicinal and Pharmaceutical Materials and the Plants, Animal and Minerals from Which They are Derived (2nd ed.), George MacDonald Hocking, Plexus Publication (1997).
8. The Evolution of Drug Discovery: From Traditional Medicines to Modern Drugs. Enrique Ravina, Hugo Kubinyi, John Wiley & Sons (2011).
9. Evidence-Based Validation of Herbal Medicine, Pulok K. Mukherjee, Elsevier, (2015).
10. Biologics in General Medicine, Wolf- Henning Boehncke, Heinfried H. Radeke, Springer, (2007).

Second Professional

Chemical Pharmacognosy-I

PHG-412
Cr. Hrs. 3

1. Carbohydrates and Related Compounds

Introduction and classification of carbohydrates. Uses of carbohydrates as medicinal agent or pharmaceutical aid: source, physical features, chemistry, uses and method of extraction of dextrose, fructose, sorbitol/glucitol, Xylitol, mannose/ mannitol, sucrose, maltose, lactose, starch, cellulose, pectin, tragacanth gum, guar gum, agar, alginic acid, carrageenan, laminarin, fucoidan.

2. Fats and Fixed Oils

Introduction, classification; extraction and quality control methods of fixed oils and fats. Sources, physical features, chemical composition, medicinal and pharmaceutical uses of castor oil, cotton seed oil, olive oil, peanut oil, sesame oil, sunflower oil, corn oil, coconut oil, almond oil, flax seed oil, canola oil, soya oil. chaulmoogra oil, mustard oil, palm oil, lanolin, carnaubas wax and bee wax.

3. Volatile Oils

Introduction, classification, biosynthesis and extraction methods of volatile oils. Sources, physical features, chemical composition, medicinal and pharmaceutical uses of clove oil, fennel oil, coriander oil, orange oil, eucalyptus oil, peppermint oil, anise oil, turpentine oil, lemon peel oil, citronella oil, caraway oil and thyme oil.

4. Resins and Oleoresins

Introduction and classification of resins and oleo resins. Sources, physical features, chemical composition, medicinal and pharmaceutical uses of jalap, turpentine, asafoetida, benzoin, rosin, cannabis, podophyllum, ipomea, myrrh and balsam.

5. Tannins

Introduction, classification, extraction and identification of tannins. Source, physical features, chemical composition, medicinal and pharmaceutical uses of tannins found in *Acacia catechu*, *Camellia sinensis*, *Castanea sativa*, *Krameria triandra*, *Pterocarpus marsupium*, *Punica granatum*, *Quercus infectoria* and *Terminalia chebula*.

6. Steroids

Introduction, classification, biosynthesis, extraction and isolation of steroids. Sources, physical features, chemical composition, and medicinal uses of bile acids, plant sterols (*Glycine max*), cardiac glycosides (*Digitalis purpurea*, *Digitalis lanata*, *Convallaria majalis*, *Strophanthus kombe*, *Urginea maritima*, *Nerium oleander*), vitamin D and withanolides.

Books Recommended

1. Biosynthesis of Natural Products, Manitto P., John Wiley and Sons, New York (1981).
2. Chromatography: Fundamentals and Applications of Chromatographic and Electrophoretic Methods. Part A, Fundamentals and Techniques, E. Heftmann, Elsevier Scientific Publishing Company, Amsterdam (1983).
3. Herbal Drugs and Phytopharmaceuticals, Norman G. Bisset (Ed.), Medpharm Scientific Publishers, Stuttgart (1994).
4. Medicinal Natural Products: A Biosynthetic Approach (3rd ed.), Paul M Dewick, John Wiley and Sons, Ltd., Chichester (2009).
5. Fundamentals of Pharmacognosy and Phytotherapy, (3rd ed.), Michael Heinrich, Elizabeth M. Williamson, Simon Gibbons, Joanne Barnes, Jose Prieto-Garcia, Elsevier Health Sciences, (2018).
6. Textbook of Pharmacognosy and Phytochemistry, (1st ed.), Avinash Seth, Biren Shah, Elsevier India (2010).

7. Pharmacognosy: Fundamentals, Applications and Strategies, (1st ed.), Rupika Delgoda (Author), Simone Badal McCreath (Editor) Academic Press (2016).
8. Pharmacognosy: Current Herbal Medications and Natural Product Chemistry for a Pharm D Curriculum, Yan Zhang, Cognella Academic Publishing (2020).
9. Drugs of Natural Origin, A Treatise of Pharmacognosy, (7th ed.), Gunnar Samuelsson, Lars Bohlin, Swedish Pharmaceutical Press (2015).
10. Tannins: Types, Foods Containing, and Nutrition, Georgios K. Petridis, Nova Science Publishers (2011).

Third Professional

Herbal Quality Control Lab-II

PHG-512
Cr. Hrs. 3

1. Extraction, Isolation and identification of Natural Products

- i. Extraction and isolation of starch from the tubers of *Solanum tuberosum*.
- ii. Identification of starch isolated from tubers of *Solanum tuberosum* by chemical methods.
- iii. Extraction and isolation of pectin from the inner pericarp of *Citrus paradisi* fruit.
- iv. Identification of pectin isolated from the inner pericarp of *Citrus paradisi* fruit by chemical method.
- v. Extraction and isolation of caffeine from *Thea sinensis* leaves.
- vi. Extraction and isolation of piperine from *Piper nigrum* fruits.
- vii. Extraction and isolation of myristicin and trimyristicin from *Myristica fragrans* seed.
- viii. Extraction and isolation of Lycopene and β -Carotene from *Solanum lycopersicum* fruits.
- ix. Extraction of volatile oil from plant sources by distillation methods. *Myristica fragrans*, *Trachyspermum ammi*, *Eugenia caryophyllus*, *Carum carvi*
- x. Identification of volatile oils by pharmacopeial methods.
- xi. Extraction of fixed oil by solvent extraction method (Soxhlet). (*Sesamum indicum*, *Arachis hypogea*, *Prunus amygdalus var. amara*)
- xii. Analysis of oils adulterated with Sesame seed oil by Baudouin test.
- xiii. Analysis of oils adulterated with Castor seed oil by chemical methods.
- xvi. Determination of saponification value, iodine number, acid number and peroxide value of the fixed oils. (*Sesamum indicum*, *Arachis hypogea*, *Prunus amygdalus var. amara*)

2. Preliminary Screening of Natural Products

- i. Detection of carbohydrates, tannins, alkaloids, glycosides, steroids, saponins, terpenes and flavonoids in the following plant extracts by chemical reagents: *Camellia sinensis*, *Cassia senna*, *Cassia fistula*, *Cordia myxa*, *Datura stramonium*, *Glycyrrhiza glabra*, *Strychnos nux-vomica*, *Sapindus trifoliatus*, *Uncaria gambir*.

3. Chromatography

- i. Identification of caffeine isolated from *Thea sinensis* leaves by T.L.C method.
- ii. Identification of piperine from *Piper nigrum* fruits by T.L.C method.
- iii. Identification of myristicin and trimyristicin isolated from *Myristica fragrans* seed by T.L.C method.
- iv. Identification of Lycopene and β -Carotene isolated from *Solanum lycopersicum* fruit by T.L.C method.
- v. Separation of color pigments from *Bougainvillea glabra* flower petals by column chromatography.

- vi. Qualitative and quantitative assessment of glycyrrhizin present in the root extract of *Glycyrrhiza glabra* by HPLC.
- vii. Characterization of Flavonoids present in medicinal plants by Thin Layer Chromatography (*Ruta graveolens* herb, *Matricaria chamomilla* flowers, *Carum carvi* fruit).
- viii. Analysis of *Digitalis purpurea* leaf extract of by paper chromatography.
- ix. Determination of the color pigments present in leaf extract by T.L.C. method.
- x. Analysis of *Strychnos nux-vomica* extract (acid or alkaline) for the presence of strychnine and brucine by thin layer chromatography (TLC).
- xi. Determination of ephedrine in *Ephedra sinica* stem through ion exchange chromatography.
- xii. Separation of alkaloids from an extract of *Atropa belladonna* through ion exchange chromatography.
- xiii. Characterization of herbal extracts of the following drugs by TLC /HPTLC Finger Printing.
(*Aegle marmelos*, *Aloe spp.*, *Cassia senna*, *Ocimum tenuiflorum*, *Phyllanthus emblica*, *Withania somnifera*).

4. Spectroscopy

- i. Analysis of Pharmacopeial compounds of natural origin and plant extracts by UV-Vis spectrophotometer.
- ii. Authentication and identification of crude drugs extract by fluorescence analysis.

Books Recommended

1. Chromatography: Concepts and Contrasts (2nd ed.), James M. Miller, Wiley-Interscience (2009).
2. Green Extraction of Natural Products: Theory and Practice, (1st ed.), Farid Chemat, Jochen Strube (Eds.) Wiley-VCH (2015).
3. Natural Products Isolation: Methods and Protocols, (3rd ed.), Satyajit D. Sarker, Lutfun Nahar (Eds.), Springer (2012).
4. Chromatography: Principles and Instrumentation (1st ed.), Mark F. Vitha, John Wiley & Sons, Inc. (2016).
5. Chromatography: Fundamentals and Applications of Chromatographic and Electrophoretic Methods. Part A, Fundamentals and Techniques, E. Heftmann, Elsevier Scientific Publishing Company, Amsterdam (1983).
6. Clarke's Isolation and Identification of Drugs, Moffat A. C., Pharmaceutical Press, London (1975).
7. Plant Drug Analysis: A Thin Layer Chromatography Atlas (2nd ed.), Hildebert Wagner, Sabine Blatt, Springer-Verlag, New York (1996).
8. Principles of Instrumental Analysis (5th ed.), Douglas A. Skoog, F. James Holler, Timothy A. Nieman, Saunders College Publishing, Philadelphia (1998).
9. Thin-Layer Chromatography: A Laboratory Handbook, Egon Stahl, Springer-Verlag (1969).
10. The Essence of Chromatography, (1st ed.), Colin Poole, Elsevier Science (2002).

Third Professional

Natural Toxins

PHG-514
Cr. Hrs. 2

1. Introduction to Natural Toxins

Introduction, classification and chemical nature of natural toxins, their toxicities in humans and animals and their applications.

2. Higher Plant Toxins

Essential oils: Terpene (cineol, pine oil), Phenylpropane (apiol, safrole, myristicin), Monoterpene (thujone, menthafuran), Plant acids (oxalic acid, amino acid, resin acid), Glycosides (cardiotonic, cyanogenic), Alkaloids (imidazole, pyrrolizidine, tropane), Lectin (*Abrus precatorius*, *Ricinus communis*), Pyridine/piperidine (*Conium maculatum*, *Lobelia inflata*), Steroidal alkaloids (*Veratrum album*).

3. Lower Plant Toxins

Bacterial toxins (*Staphylococcus aureus*, *Clostridium botulinum*), Algal toxins (*Microcystis aeruginosa*, *Cyanobacteria*, *Gonyaulax cantenella*).

4. Mycotoxins

Fungal toxins (*Aspergillus spp.*, *Claviceps purpurea*), Mushrooms (*Amanita spp.*).

5. Animal Toxins

Honey bee (*Apis mellifera*), black widow spider (*Latrodectus mactans*), Snake venom (*Bothrops Jararaca*, *Naja nana atra*), Scorpion (*Scorpiones spp.*), Gila monster lizard (*Heloderma suspectum*), Snail (*Conus magus*).

6. Prevention and Control Methods of Toxins

Description, pharmacognostic features, pharmacological actions, chemical constituents, treatment, side-effects, contra-indications, warnings, prevention and control methods of *Abrus precatorius*, *Apis mellifera*, *Bungarus sindanus*, *Datura stramonium*, *Digitalis purpurea*, *Latrodectus mactans*, *Nicotiana tabacum*, and *Papaver somniferum* poisoning.

Books Recommended

1. Dictionary of Plant Toxins, Jeffery B. Harborne, Herbert Baxter, Gerard P. Moss (Eds.), John Wiley, Chichester (1996).
2. Herbal Products, Toxicology and Clinical Pharmacology (2nd ed.), Timothy S. Tracy, Richard L. Kingston (Eds.), Humana Press, Totowa (2007).
3. Microbial Toxins (1st ed.), P. Gopalakrishnakone, Brad Stiles, Alberto Alape-Girón, J. Daniel Dubreuil, Manas Mandal (Eds.), Springer (2018).
4. Poisonous Plants of Pakistan, S. H. Abid Askari, Oxford University Press, (2010).
5. Poisonous Plants: A Hand Book for Doctors, Pharmacists, Toxicologists, Biologists and Veterinarians (2nd ed.), Dietrich Forhne, Hans J Pfander, Manson Publishing, London (2005).
6. Poisonous Plants and Related Toxins, Thomas Acamovic, Colin S. Stewart, T. W. Pennycott, CABI (2003).
7. Poisonous Plants of all Countries (2nd ed.), Arthur-Bernhard Smith, Periodical Expert Book, Delhi (1988).
8. Plant Toxins (1st ed.), P. Gopalakrishnakone, Célia Regina Carlini, Rodrigo Ligabue-Braun (Eds.), Springer (2017).
9. Poisonous Plants and Phytochemicals in Drug Discovery, Andrew G. Mtewa, Chukwuebuka Egbuna, G.M. Narasimha Rao (Eds.), John Wiley and Sons Ltd. (2020).
10. The Toxin Solution: How Hidden Poisons in the Air, Water, Food, and Products We Use are Destroying Our Health-And What We Can Do To Fix It, Joseph Pizzorno, Harper One (2017).

English (Compulsory)

1. Parts of speech and articles
2. Verb – Transitive and intransitive verbs
3. Active and passive voice
4. Modal verbs
5. Skimming and scanning

6. Precise writing and comprehension
7. Letter writing
8. Memo
9. Minutes of the meeting
10. How to write research proposals + term papers
11. Presentation skills
12. Technical writing
13. Note – taking
14. Essay writing

Books Recommended

1. English Grammar in use by Raymond Murphy.
2. The Art of Public speaking by Stephen E. Lucas.
3. The North Field Guide to writing, with Readings Editions by Richard Bullock Maureen.
4. Dalay Goggin.
5. Critical Theory Today: A user-friendly guide by Lois Tyson.
6. A Practical English Grammar by A. J. Thomson & A. V. Martinet.
7. Practical English Usage by Michael Swan.
8. The Power of Communication: Skills to build trust, inspire loyalty and lead effectively by Helio Fred Gracia.
9. Power Listening: Mastering the most critical business skills of all by Bernard T. Ferrari.
10. English Grammar by Wren & Martin.

Pharm. D. (Deficiency) Courses

1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHG - 713(D)	Clinical Pharmacognosy	2	PHG-514(D)	Natural Toxicants	2
Total 02 Courses making 04 Credit Hours in one year.					

First Semester

Clinical Pharmacognosy

PHG-713(D)
Cr. Hrs. 2

1. Introduction to clinical Pharmacognosy

General introduction and historical background of clinical Pharmacognosy. Study of causes, pathogenesis, clinical features (sign and symptoms), diagnosis, prognosis, prevention and epidemiology of chronic diseases; principles of medication, treatment by herbal medicines.

2. Clinical Use of herbal medicine

Diabetes:	<i>Gymnema sylvestre, Melia azadirchta, Momordica charantia, Syzygium jambulana.</i>
Cardiac diseases:	<i>Digitalis spp., Convallaria majalis, Urgenia indica, Allium sativum, Punica granatum.</i>
Hepatitis:	<i>Berberis vulgaris, Picrorhiza kurroa, Lawsonia innermis.</i>
Respiratory diseases:	<i>Ficus religiosa, Adhatoda vasica.</i>
Skin diseases:	<i>Aloe vera, Angelica archangelica, Mentha piperita, Citrus spp., Commiphora mukul.</i>
CNS disorders:	<i>Strychnos nux-vomica, Datura stramonium, Cannabis sativa, Papaver somniferum, Atropa belladonna.</i>
Musculo-skeletal Disorders:	<i>Nigella sativa, Phycotis ajowan, Trigonella foenum-graecum, Zingiber officinale.</i>
Renal disorders:	<i>Cucumis melo, Berberis vulgaris, Zea mays, Tribulus terrestris.</i>
Reproductive Disorders:	<i>Saraca indica, Ruta graveolens, Nigella sativa, Glycyrrhiza glabra, Claviceps purpurea, Myristica fragrance.</i>
G.I.T. disorders:	<i>Foeniculum vulgare, Ferula foetida, Cuminum cyminum, Aegle marmelos, Prunus domestica.</i>

Books Recommended

1. Principle and Practice of Phytotherapy: Modern Herbal Medicine, Kerry Bone, Simons Mills, Churchill Livingstone (2013).
2. Pharmacological Methods in Phytotherapy Research, Selection, Preparation and Pharmacological Evaluation of Plant Material (vol.1), Elizabeth M. Williamson, David T. Okpako, Fred J. Evans, Wiley Publishers, (1996)

3. Encyclopedia of World Medicinal Plants (vol. 5), T-Pullaiyah., Regency Publication, New Delhi (2006).
4. Natural Products: Drug Discovery and Therapeutic Medicine, Lixin Zhang, Arnold L. Demain (Eds.), Humana Press (2005).
5. Hand Book of Clinical Pharmacy, Dr. A. V. Yadav, B.V. Yadav, t.I. Shaikh, Nirali Parkashan, Pune (2008).

Second Semester

Natural Toxicants

PHG-514(D)

Cr. Hrs. 2

1. General introduction to plant toxicology

Classification and chemical nature of natural toxins and toxicities in humans and animals.

2. Higher plant toxins

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

3. Lower plant toxins

Bacterial toxins (*Staphylococcus aureus*, *Clostridium botulinum*), Algal toxins (*Microcystis aeruginosa*, Cyanobacteria, *Gonyaulax cantenella*).

4. Mycotoxins

Fungal toxins (*Aspergillus spp.*, *Claviceps purpurea*), Mushrooms (*Amanita spp.*).

5. Study of toxins, their prevention and control methods

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

Books Recommended

1. Herbal Products, Toxicology and Clinical Pharmacology, Timothy S. Tracy, Richard L. Kingston (Eds.), 2nd ed., Humana Press, Totowa (2007).
2. Poisonous Plants of Pakistan, S. H. Abid Askari, Oxford University Press, (2010).
3. Poisonous Plants: A Hand Book for Doctors, Pharmacists, Toxicologists, Biologists and Veterinarians (2nd ed.), Dietrich Forhne, Hans J Pfander, Manson Publishing, London (2004).
4. Poisonous Plants and Related Toxins, Thomas Acamovic, Colin S. Stewart, T. W. Pennycott, CABI (2003).
5. Poisonous Plants: A Hand Book for Doctors, Pharmacists, Toxicologists, Biologists and Veterinarians (2nd ed.), Dietrich Forhne, Hans J Pfander, Manson Publishing, London (2004).



Department of
**Pharmacy
Practice**



As a demand of the international paradigm shift in the pharmacy orientation from pill to patient, the pharmacy education regulatory body in Pakistan, Pharmacy Council of Pakistan required to revisit its curricula. As a result of which, a department of Pharmacy Practice was added peculiarly to focus on the pharmaceutical care practices. Pharmacy practice department in the faculty of Pharmacy and Pharmaceutical Sciences aims to impart and acquaint the students of pharmacy to the standards of practices in pharmaceutical care to obtain the best therapeutic outcomes in order to improve the patient's quality of life. The courses in the department emphasizes on right from the basics of the health in a society to a complex direct patient care at the patients bed side. It includes the fundamentals of the pharmacy practice, introduces the students to the practice aspects and explore the insights of the practical approach that covers medication error reporting, Adverse Drug Reactions, Drug interactions, Therapeutic Drug Monitoring, institutional and non-institutional pharmacy practices.

The need of the real time practices is also part of the curricula that requires the students to get involved in trainings, internships and clerkships in hospital setups. To meet the demand of the courses, faculty of pharmacy and pharmaceutical sciences has signed MoUs with several tertiary care general and specialist hospitals of the city where the students would learn the aspects by practicing under the supervision of skilled professionals. The mission statement of the Department of Pharmacy Practice is to produce highly qualified pharmacists, for Hospital, Community setups, researchers and leaders able to manage in diverse environments and to ultimately improve health in the society.

The Department of Pharmacy Practice, as a future perspective, will not only produce competent pharmacists but will also proceed with the vision of active research in different areas of Pharmacy Practices by offering post graduate programs.

Faculty

Pharmacy Practice



**Dr. Iyad Naeem
Muhammad**

Coordinator and
Associate Professor

Qualification

**Ph.D., M. Phil., B. Pharm., B.Sc.
(University of Karachi)**

Year of Association

2006

Subjects of Interest

**Pharmaceutical Sciences, Pharmacy
Practice, Pharmaceutical Microbiology,
Hospital Pharmacy, Pharmaceutical
Technology, Pharmacokinetics, Formulation
Development.**

Area of Research Interest

**Pharmacokinetics, Formulation
Development, Pharmaceutical
Biotechnology, Pharmaceutical
Microbiology, Pharmacy Practice**

Email

iyadnaem@uok.edu.pk

Phone Number

(+92-21) 99261300-7 Ext. 2252

Board of Studies

Dr. Faiyaz HM Vaid

Professor and Dean,
Faculty of Pharmacy and Pharmaceutical Sciences

Dr. Iqbal Azhar

Professor and Chairman
Department of Pharmacognosy

Dr. Iyad Naeem Mohammad

Coordinator
Department of Pharmacy Practice

Dr. Rabia Ismail

Chairperson
Department of Pharmaceutics

Dr. Syeda Afroz

Chairperson
Department of Pharmacology

Dr. Sohail Hassan

Chairperman
Department of Pharmaceutical Chemistry

Mr. Abdul Latif Sheikh

President/CEO,
Pakistan Society of Health System Pharmacists,
Karachi.

Dr. Muhammad Ali Sheraz

Professor and Chairman
Department of Pharmacy Practice and Director,
Baqai Institute of Pharmaceutical Sciences,
Baqai Medical University, Karachi.

Mr. Nasir Abdul Jalil

Consultant – Pharmacy Systems Development,
Children's Hospital, Gulshan-e-Iqbal, Karachi.

Dr. Sheikh Abdul Khaliq

Professor and Chairman
Department of Pharmacy Practice
Faculty of Pharmacy,
Hamdard University, Karachi.

Pharm. D. Courses

1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
Fourth Year					
PHP - 601	Pharmacy Practice - Hospital Pharmacy	3	PHP - 602	Pharmacy Practice - Community, Social and Administrative Pharmacy	3
Fifth Year					
PHP - 705	Pharmacy Practice - Clinical Pharmacy	3	PHP - 714	Pharmacy Practice - Pharmacotherapeutics	3
Total 4 Courses, making 12 Credit hours in five years.					

First Semester

Fourth Professional

Pharmacy Practice: Hospital Pharmacy

PHP-601
Cr. Hrs. 3

1. Hospital and Its Organization:

- a. Brief history of hospital
- b. Classification of hospitals
- c. Minimum requirements for registering a hospitals
- d. Organizational structure
- e. Administration
- f. Clinical departments
- g. Nursing, dietetic, pathology, blood bank, radiology and other supportive services
- h. Hospital finances

2. Role of Pharmacy in Hospitals, Role of Pharmacist in Small Hospitals, Nursing Homes etc.

3. Minimum Standards for Hospital Pharmacies as per ASHP

Pharmacy, its organization and personnel:

- a. The Physical plant and its equipment
- b. Pharmacy specialist
- c. Drug information centre
- d. Poison control centre and antidote bank
- e. Pharmacy education, CEs and CMEs, internship program, clerkship, etc.
- f. Professional services rendered
- g. The Pharmacy: central sterile supply room (eye drops, ear drops) and hyper alimentation.
- h. Nuclear pharmacy
- i. Investigational use of drugs
- j. Health accessories, ancillary supplies and surgical supplies

4. Dispensing to Inpatients

- a. Methods of dispensing and SOP's
- b. Unit dose dispensing
- c. Other concepts of dispensing, satellite pharmacy etc.

5. Dispensing to Ambulatory Patients

6. The Hospital Formulary System: guidelines of AHFS

7. Controlled Substances: Procurement, Distribution, Dispensation and Inventory Management

8. Dispensing During Off-Hours, Off Site Pharmacies

9. Purchasing, Distribution and Control of Hospital Medicines, Medical and surgical supplies

Supply chain management and execution: purchasing, stocking, stock control, inventory management, drug distribution, relationship between purchasing, distribution and clinical pharmacy services.

10. 200 Contact Hours Hospital Pharmacy Internship in a Tertiary Care General Hospital Covering the Clinical Units.

Books Recommended

1. Pharmacy Practice By Kevin M. G. Taylor, Geoffrey Harding; CRC Press.
2. Holdford, D. A. and T. R. Brown (2010). Introduction to Hospital and Health-System Pharmacy Practice, ASHP.
3. Thompson, J. E. (2009). A Practical Guide to Contemporary Pharmacy Practice Third Edition, Williams & Wilkins Baltimore (MD).
4. Brown, T. R. (2006). Handbook of Institutional Pharmacy Practice, ASHP.
5. Stephens, M. (2011). Hospital Pharmacy, Pharmaceutical Press.
6. Hospital Pharmacy by W.E. Hassan, Lea & Fibiger

Fifth Professional

Pharmacy Practice: Clinical Pharmacy

**PHP-705
Cr. Hrs. 3**

1. **Rationalize Use of Drugs**
2. **Medication Errors**
3. **Drug Utilization and Drug Utilization Review**
4. **Lab Data Interpretation and Monitoring (ADR etc.)**
5. **Developing and Implementing TDM**
6. **Documentation of Pharmacotherapy Plan**
 - SOAP (Subjective, Objective, Assessment and Plan) note
 - CORE (communication, organization, relationship and expectations) pharmacotherapy plan
 - PRIME (pharmaceutical based problems, risk to patient, interactions, mismatch between medications and conditions or patients need and efficacy issues) pharmacotherapy problems
 - FARM (findings, assessment, resolution and monitoring and follow up) note
7. **Pharmacotherapy Decision Making.**
8. **Pharmaco-Economics and its Implementation**
9. **Public Health Issues and Different Models to Study e.g tobacco cessation programs, obesity prevention, tuberculosis monitoring, vaccinations etc.**
10. **CNS Unit (psychosis, stroke, epilepsy), GI Unit**
11. **Oncology Unit (solid and other cancers)**
12. **Ossso Unit (bone density, rickets, osteoporosis)**
13. **Gastroenterology Unit (ulcers, cirrhosis, hepatitis etc.)**

Books Recommended

1. Pharmacotherapy A Pathophysiologic Approach 9/E By Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; McGraw Hill Professional
2. Thompson, J. E. (2009). A practical guide to contemporary pharmacy practice Third Edition, Williams & Wilkins Baltimore (MD).
3. Lauster, C. D. and S. B. Srivastava (2013). Fundamental Skills for Patient Care in Pharmacy Practice, Jones & Bartlett Publishers.
4. Lexi-Comp, Inc. OnlineTM, L.-C., L.-D. OnlineTM, et al. (2015).
5. Ansel, H. C. (2012). Pharmaceutical calculations, Lippincott Williams & Wilkins
6. Koda-Kimble, M. A., B. K. Aldredge, et al. (2012). Koda-Kimble and Young's Applied Therapeutics: The Clinical Use of Drugs, Lippincott Williams & Wilkins.
7. Chisholm-Burns, M. A., B. G. Wells, et al. (2010). Pharmacotherapy principles & practice, McGraw-Hill New York.

First Semester Fourth Professional

Pharmacy Practice: Community, Social & Administrative Pharmacy

PHP-602
Cr. Hrs. 3

1. Definitions and background:

Health and its types, fundamentals of health, health determinants, health care system, health care organizations and institutes, public health and community pharmacy.

2. Epidemiology, Epidemiological Methodology with a Focus on Specific Disease States, Pharmacoepidemiology.

3. Preventive health (EPI & CDC), Family Planning and Health Policy.

4. Medical Complication of Drug Taking: General and Socio-Economic Aspects.

5. Pharmacy Layout Design

Objectives of layout design, types of community pharmacies (pharmaceutical center, prescription-oriented pharmacies, traditional pharmacies and the super drug stores chain of pharmacies), consumer goods and purchases, classes of layout designs, principles and characteristics of layout design and traffic flow analysis.

6. Operations in a Community Pharmacy

- a. Procurement of drugs, medical devices, health accessories, ancillary supplies
Good storage practices in community pharmacy.
- b. Compounding and dispensing including:
Fundamental operations in compounding, containers and closures for dispensed products.
- c. Prescription-handling (parts of prescription, filling, interpretation, pricing) and labelling of dispensed medication.
- d. Extemporaneous dispensing: solutions, suspensions, emulsions, creams, ointments, pastes and gels, suppositories and pessaries, powders and granules and oral unit dosage form.
- e. Pharmaceutical incompatibilities: types of incompatibilities, manifestations, correction and prevention with reference to typical examples.
- f. Patient education and counselling, educational role of community pharmacy.
- g. Control of drug abuse and misuse in community pharmacy.

7. Role of Pharmacist: as Public Health Educator in the Community for Drug Monitoring and Drug Information

8. Pharmacoeconomics: pharmacoeconomic modelling and interpretation

9. Alternative Therapies

Background, philosophy and use of complementary and alternative therapies in practice including herbal medicines, homoeopathy, acupuncture, acupressure, Bach Flower remedies, aromatherapy and reflexology.

10. One Month Training in Community Pharmacy and DIC Under the Supervision of Licensed Registered Pharmacist

Books Recommended

1. Jean-Venable R. Goode, Lynne M. Roman, Kristin W. Weitzel. Community Pharmacy Practice Case Studies.
2. Pharmacy Practice By Kevin M. G. Taylor, Geoffrey Harding; CRC Press.
3. Pharmacoeconomics: From Theory to Practice By Renee J. G. Arnold.
4. Community Pharmacy By Paul Rutter.
5. Thompson, J. E. (2009). A practical guide to contemporary pharmacy practice Third Edition, Williams & Wilkins Baltimore (MD).
6. Lauster, C. D. and S. B. Srivastava (2013). Fundamental Skills for Patient Care in Pharmacy Practice, Jones & Bartlett Publishers.
7. Beardsley, R. S., C. L. Kimberlin, et al. (2012). Communication skills in pharmacy practice: a practical guide for students and practitioners, Lippincott Williams & Wilkins.
8. Leadership and Management in Pharmacy Practice, Second Edition (Pharmacy Education Series). Jan 2, 2015. CRC Press.

Fifth Professional

Pharmacy Practice: Pharmacotherapeutics

PHP-714
Cr. Hrs. 3

Pharmacotherapy of Drugs Used in:

1. CVS Unit (covering IHD, hypertension etc.).
2. Pulmonary Unit (asthma, COPD, pneumonia etc.).
3. Infection Unit (bacterial, fungal and viral infections).
4. Endocrinology Unit (DM, hyper / hypothyroidism etc.).
5. Nephrology Unit (renal failures etc.).
6. Hematology Unit (bleeding disorders, coagulopathies)
7. Manufacturing Bulk and Sterile: Total parenteral nutrition (TPN)

Books Recommended

1. Pharmacotherapy A Pathophysiologic Approach 9/E By Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; McGraw Hill Professional.
2. Lauster, C. D. and S. B. Srivastava (2013). Fundamental Skills for Patient Care in Pharmacy Practice, Jones & Bartlett Publishers.
3. Lexi-Comp, Inc. OnlineTM, L.-C., L.-D. OnlineTM, et al. (2015).
4. Koda-Kimble, M. A., B. K. Aldredge, et al. (2012). Koda-Kimble and Young's Applied Therapeutics: The Clinical Use of Drugs, Lippincott Williams & Wilkins.
5. Chisholm-Burns, M. A., B. G. Wells, et al. (2010). Pharmacotherapy principles & practice, McGraw-Hill New York.

Important Rules to Remember

1. Rules Concerning the Promotion and Repetition of Courses

The student passing at least 80% courses in an academic year would be promoted to next higher class. There would be no special examination for courses of Pharm. D. first to fifth professional class. Students requiring to pass such a course, shall repeat it along with the regular class. There may be a supplementary examination for the failures of the Pharm. D. fifth Professional. This examination will be held after six weeks of the announcement of the Pharm. D. (Final) results.

2. Attendance

Attendance at in each subject is compulsory for all students and no student shall be eligible to appear at any University examination unless he has attended 75 per cent classes in the course.

Shortage in attendance up to 5 per cent only may be condoned by the Dean for bonafide reasons. The Vice-Chancellor may condone a further shortage of 10 per cent in cases of special hardship, but no student whose attendance falls below 60 per cent shall be sent up for any University examination.

Attendance will be counted from the date classes begin and NOT from the date of admission of a student. Provided that the attendance of a student admitted after rendering National Service will be counted from the date of his admission.

A student who shows indifference to his studies by continued absence for 3 weeks from the date of his admission shall cease to be a student of the University. Appeal against the cancellation of admission may be made to the Chairman of the Department and the Dean's decision in this behalf shall be final.

3. Maximum Duration for Completion of Degree

Maximum duration for completion of Pharm-D. degree will be seven years. After this period fresh admission at the level of Pharm-D. 1st Year will be required.

Guidelines to Participate in Convocation

These are some notes which provide help you to know the ethics for the participation of Convocation, which will be memorable moments in your life:

- Do not forget to bring your Invitation Card with you, because entry will not be allowed without Invitation Card
- Participating graduates may be accompanied by his/her parent/guardian as specified by them during registration.
- Degree participants should reach the convocation ground on time.
- Wear the special dress, including the gown, hood and the special cap.
- The hood color represents your faculty, and for Pharmacy, the color is gray.
- Before the endorsement of degree, the tassel of the cap is on your right side.
- After the degree is conferred, bow down your head, and change the direction of the tassel to your left this is called turning of tassel indicating that now you are a graduate.
- Leave the ground quickly and at the end of the ceremony after all the degrees are conferred, throw your cap in air to show your happiness and joy.

Academic Calendar 2024

Academic Calendar (Morning Program)

First Semester 2023

Orientation Day	January 18, 2023
Teaching	January 19 – May 19, 2023
Semester Examinations	May 26 – June 13, 2023
Semester Break	June 14 – July 04, 2023

Second Semester 2023

Teaching	July 05 – November 03, 2023
Semester Examinations	November 13 – December 08, 2023
Semester Break	December 11 – 29, 2023

Academic Calendar (Evening Program)

First Semester 2023

Orientation Day	February 10, 2023
Teaching	February 13 – March 21, 2023
Ramadan / Eid-ul-Fitr Break	March 22 – April 25, 2023
Teaching Resume	April 26 – July 17, 2023
Semester Examinations	July 19 – August 23, 2023

Second Semester 2023

Teaching	August 24 – December 21, 2023
Semester Examinations	December 25 – January 15, 2023
Semester Break	January 16, 2023

Academic Calendar 2023

Academic Calendar (Morning Program)

First Semester 2024

Orientation Day	January 15, 2024
Teaching	January 16 – May 17, 2024
Semester Examinations	May 21 – June 12, 2024
Semester Break	June 13 – July 05, 2024

Second Semester 2024

Teaching	July 08 – November 08, 2024
Semester Examinations	November 14 – December 06, 2024
Semester Break	December 07 – December 31, 2024

Academic Calendar (Evening Program)

First Semester 2024

Orientation Day	February 12, 2024
Teaching	February 13 – March 08, 2024
Ramadan / Eid-ul-Fitr Break	March 11 – April 14 2024
Teaching Resume	April 15 – July 25, 2024
Semester Examinations	July 29 – August 23, 2024
Semester Break	August 24, 2024 – August 31, 2024

Second Semester 2024

Teaching	September 2 – December 27, 2024
Semester Examinations	January 1 – January 22, 2025
Semester Break	January 22 – February 02, 2025



FACULTY OF
**Pharmacy and
Pharmaceutical
Sciences**

University of Karachi, Karachi-75270
Telephone: 9261300-06 Ext:2220
email: deanpharm@uok.edu.pk