

**Ministry of Health and Medical Education**  
**The Higher Council for Curriculum Development**

General Specifications, Curriculum, Course Descriptions and Pharm.D Curriculum Evaluation Method.

**Approved in the 28<sup>th</sup> meeting of the Higher Council for Curriculum Development**

## **In the Name of God**

**Field: Pharmacy**

**Program: Doctor of Pharmacy (Pharm.D.)**

**Specialized Pharmacy Education Secretariat**

The higher council for medical curriculum development approved this curriculum in its 28<sup>th</sup> meeting held on 6/20/2005 based on the Pharm.D program, which was approved by the Specialized Pharmacy Education Secretariat. The curriculum for this program is presented in 4 sections (general specifications, curriculum, course descriptions and curriculum evaluation):

1. Since approval, the Pharm.D program is effective in all universities and higher education centers having the following features:
  - a. Universities and higher education centers working under the supervision of the Ministry of Health and Medical Education
  - b. All higher education institutes founded with the approval of the Ministry of Health and Medical Education and are therefore subject to the rules and regulations of the Higher Council for Medical Curriculum Development
  - c. Other higher education institutes founded and governed by specific laws and must follow the academic regulations of the Islamic Republic of Iran.
2. Starting on 6/20/2005 all educational programs and similar institution curricula related to Pharm.D education are abolished in all universities and higher education centers, and they are all to use the new curriculum.
3. The general specifications, curriculum, course definitions and curriculum evaluations of the Pharm.D curriculum are presented in four sections.

# **Chapter One**

## **General Specifications of the Curriculum**

**Name and Definition:**

Doctor of pharmacy (Pharm.D.) is a field in medical sciences, designed to meet the pharmacy-related medical needs of society.

**History of the Field and Recent Breakthroughs:**

At the beginning of the twentieth century pharmacy was introduced as an independent field of study due to man's need for new cures, the chemical and biological advances happening at the time, the close relations between different scientific disciplines and also the possibility to explore and present new treatment processes using new drugs and pharmaceutical products. In Iran this happened in 1935, after the independence of the field from medicine, and the establishment of the school of pharmacy. Over time, because of the high demand for services of pharmaceutical scientists, and the necessity to develop curricula for the field, more pharmacy departments were established in Tehran, Tabriz, Isfahan, Mashhad, Ahvaz, Kerman, Shiraz, Sari and Kermanshah. The pharmacy curriculum was developed by the Cultural Revolution Council in 1983, and then reviewed in 1989 with minor changes made. Today, in addition to establishing new pharmacy departments, each department has built research centers and designed more specialized programs based on specific medical needs of society.

**Values and Beliefs**

The right to health and healthy living environment is of the basic rights of mankind. As pharmacy has crucial applications in social health services, considering this right is of high prominence in this field. Islamic scientists have always been pioneers of the path to know environment and drugs, and this curriculum emphasizes the rich Iranian culture and the importance of ethics, particularly medical ethics. Another prominent need of human beings is to find a better understanding of the universe and its creation, therefore in this curriculum extra attention is dedicated to knowledge increase and research areas to pave the way for solving the mysteries of the universe. In this curriculum new and old educational methods are combined to promote critical thinking, independence, decision making skills and professional abilities on the part of the learners, based on society needs and priorities.

#### **4. Mission**

Our major responsibility is to train scientists who can provide health care services, practice in research and programming organizations and provide pharmaceutical services. Training such scientists will lead to health care system progress; moreover, using new methods and technologies to develop novel pharmaceutical products and providing consultation, helps diagnose, treat and prevent diseases. Therefore creativity, innovation, team work and professional ethics are central to this field.

#### **5. Vision**

In an ever-changing and constantly evolving world, a pharmaceutical scientist has an effective and crucial role in raising the standing of Iran in different educational and research areas and fulfilling the demands of a progressing society, in collaboration with other medical scientists and specialists. We hope that this educational curriculum will raise the standing of the field and help it to meet international standards. Therefore it is highly hoped that this field can find its true position in national and international circles in the next 10 years.

#### **6. Aims**

Pharmaceutical scientists are expected to have sufficient general knowledge in different areas of pharmaceutical sciences and be able to meet related needs of the society. The general aims of this field are as follows:

- a. Meeting the general educational and research needs to better understand pharmaceutical sciences and all related factors.
- b. Knowing all scientific and practical research in the area of pharmaceutical sciences.
- c. Increasing knowledge and skills in:
  - Thorough knowledge of the existing drugs in pharmacopoeia
  - The ability to manage general and specialized pharmacies and guiding patients and doctors to use pharmaceutical products correctly.
  - Making of drugs and cosmetics at pharmacy level
  - Making of drugs and cosmetic products at industrial level.
  - Quality and quantity control of pharmaceuticals, foods and cosmetics.
  - Preventing poisoning and drug side effects
  - Knowledge of pharmaceutical sciences references
  - The ability to recognize and plan for all health and pharmaceutical related issues at a national level.
  - Cultures and mindsets of different peoples
  - Research and educational subjects

- Promotion of professional ethics

## **7. The role of scientists in the educational program**

Graduates will be able to act in several fields as follows:

1. Service
2. Management fields
3. consultation and education fields
4. Research fields

## **8. Professional duties of the scientists**

They can provide service in:

1. Urban pharmacies to supervise dispense prescriptions and offer guidance to patients.
2. Hospital pharmacies to supervise prescription dispensing, supply the needs of different wards and offer guidance to patients.

In consultation roles:

1. In urban and hospital pharmacies to guide patients and doctors to choose the right medicine.
2. Decreasing drug side effects by providing patients and doctors with accurate pharmaceutical information.

In management roles:

1. In pharmaceutical institutions and organizations
2. In all matters related to pharmaceuticals, including pharmaceutical companies and health care networks
3. In pharmaceutical companies to supervise drug production and control as technical supervisors

In research roles:

1. Regarding the role of the program, can provide doctors with information performing research on drug use patterns and endemics
2. In research areas of institutions and pharmaceutical companies



## **Chapter 2**

### **Program features**



**Program Name:** Doctor of pharmacy (pharm.D)

**Length of Study:** The minimum length of the Pharm.D program is 5.5 years

**First Stage:** General and fundamental courses

**Second level:** Specialized, Introductory Pharmacy Practice Experience (IPPE), Advanced Pharmacy Practice Experience and thesis

At the end of the first stage there will be a fundamental sciences exam and passing this exam is a prerequisite to entering the next level.

**Total Number of Credits:** 209

**General Courses:** 22

**Fundamental Courses:** 58

**Specialized:** 103

**Introductory Practice Experience:** 6

**Advanced Practice Experience:** 12

**Thesis:** 8

### A. General Courses

column	Course Name	Number of Credits	Hours			Prerequisites
			Theoretical	Practical	Total	
1	2 of Islamic Theories courses	4	68	-	68	-
2	Islamic Ethics	2	34	-	34	-
3	Islamic Revolution of Iran	2	34	-	34	-
4	Islamic History and Civilization	2	34	-	34	-
5	Islamic Sources	2	34	-	34	-
6	Persian Literature	3	51	-	51	-
7	General English	3	51	-	51	-
8	Physical Education1	1	-	34	34	-
9	Physical Education2	1	-	34	34	-
10	Family Planning and Population	2	34		34	-
Total		22				

## B. Fundamental Courses

Code	Course Name	Number of Credits		Hours		Number of Credits	Prerequisites
		Theoretical	Practical	Theoretical	Practical		
01	Mathematics	3	-	51	-	3	-
02	Physics	2	-	34		2	-
03	Physics	-	1		34	1	-
04	General Chemistry	4	-	68	-	4	-
05	General Chemistry	-	2	-	64	1	-
06	Molecular Biology and Genetics	2	-	34	-	2	-
07	Anatomy and Histology	2	-	34	-	2	-
08	Anatomy and Histology	-	1	-	34	1	-
09	Analytical Chemistry	2	-	34	-	2	General Chemistry
10	Analytical Chemistry	-	2	34	-	2	General Chemistry
11	Organic Chemistry1	3	-	51	-	3	General Chemistry
12	Organic Chemistry1	-	1	34	-	1	General Chemistry
13	Organic Chemistry2	3	-	51	-	3	Organic Chemistry1
14	Organic Chemistry2	-	1	-	34	1	Organic Chemistry1
15	Fundamental Biochemistry	3	-	51	-	3	-
16	Fundamental Biochemistry	-	1	-	34	1	-
17	Physiology1	4	-	64	-	4	Biochemistry, Anatomy
18	Physiology2	4	-	64	-	4	Physiology1
19	Physiology2	-	1	-	1	1	Physiology1
20	First Aid and Introduction to Medical	1	1	17	34	2	-

	Equipment						
21	Microbiology	3	-	51	-	3	Molecular Biology and Genetics
22	Microbiology	-	1	-	34	1	Molecular Biology and Genetics
23	Virology	1	-	17	-	1	Simultaneously with Microbiology
24	Parasitology and Mycology	3	-	51	-	3	
25	Parasitology and Mycology	-	1	-	34	1	
26	Immunology	3	-	51	-	3	Microbiology, Parasitology and Mycology
27	Immunology	-	1	-	34	1	Microbiology, Parasitology and Mycology
28	Health Care Principles	1	-	17	-	1	
Total		44	14			58	

**Note: practical courses are not offered before Theoretical courses.**

### C. Specialized Courses

Code	Course Name	Number of Credits		Hours		Number of Credits	Prerequisites
		Theoretical	Practical	Theoretical	Practical		
29	Psychology*	2	-	34	-	2	-
30	Sociology and Anthropology	2	-	34	-	2	-
31	Clinical Biochemistry	2	-	34	-	2	Fundamental Biochemistry
32	Medicinal Plants	2	-	34	-	2	-
33	Medicinal Plants		1	-	34	1	-
34	Pharmacognosy1	2	-	34	-	2	Medicinal Plants
35	Pharmacognosy2	3	-	51	-	2	Pharmacognosy1
36	Pharmacognosy2	-	2	-	68	2	Pharmacognosy1
37	Ethics in Pharmacy	1	-	17	-	2	-
38	Medicinal Chemistry1	3	-	51	-	3	Organic Chemistry and Pharmacology
39	Medicinal Chemistry2	3	-	51	-	3	Medicinal Chemistry1
40	Medicinal Chemistry3	3	-	51	-	3	Medicinal Chemistry2
41	Pharmacology1	4	-	68	-	3	Physiology2 and Fundamental Biochemistry
42	Pharmacology2	4	-	68	-	4	Pharmacology1
43	Pharmacology2	-	1	-	34	1	Pharmacology1
44	Toxicology	2	-	34	-	2	Pharmacology2
45	Toxicology	4	-	34	-	2	Pharmacology2
46	Poison Control	2	-	34	-	42	Toxicology, Pharmacology, First Aid
47	Physical Pharmacy1	2	-	34	2	2	Mathematics and simultaneously with Pharmaceutics3
48	Physical Pharmacy2	2	-	34	-	2	Physical Pharmacy1
49	Pharmaceutics(intro)	2	-	34	-	2	-
50	Pharmaceutics2 (solids)	3	-	51	-	3	Pharmaceutics1
51	Pharmaceutics2	-	1	-	34	1	Pharmaceutics1

	(solids)						
52	Pharmaceutics3 (liquids)	3	-	51	-	3	Pharmaceutics2
53	Pharmaceutics3 (liquids)	-	1	-	34	1	Pharmaceutics2
54	Pharmaceutics4 (semi-solids)	2	-	34	-	2	Pharmaceutics3
55	Pharmaceutic4 (semi-solids)	-	1	-	34	1	Pharmaceutics3
56	Pharmaceutics5 (novel systems)	2	-	34	-	2	Pharmaceutics4
57	Pharmaceutics5 (novel systems)	-	1	-	34	1	Pharmaceutics4
58	Cosmetics	2	-	34	-	2	Pharmaceutics4
59	Pharmacotherapy1	3	-	51	-	3	Pharmacology, Physiology
60	Pharmacotherapy2	3	-	51	-	3	Pharmacotherapy1
61	Pharmacotherapy	3	-	51	-	3	Pharmacotherapy
62	Pharmacoeconomics	2	-	34	-	2	Mathematics
63	Technical English	2	-	34	-	2	General English
64	Pharmaceutical Terminology	2	-	34	-	2	Technical English
65	Food and Regimen	3	-	51	-	3	Fundamental Biochemistry, Analytical Chemistry
66	Biopharmacy and Pharmacokinetics	3	-	51	-	3	Math, Biostatistics, Pharmaceutics5, Pharmacology2
67	Biological Products	2	-	34	-	2	Immunology
68	Cell Culture	1	-	17	-	1	Pharmaceutical Biotechnology, Molecular Biology and Genetics
69	Microbial Control of Drugs	2	-	34	-	2	Microbiology, pharmaceutics5
70	Microbial Control of Drugs	-	1	-	34	1	Microbiology, pharmaceutics5
71	Physicochemical control of Drugs	2	-	34	-	2	General Chemistry, Analytical Chemistry, Instrumental

							Analysis
72	Physicochemical Control of Drugs	-	1	34	34	1	General Chemistry, Analytical Chemistry, Instrumental Analysis
73	Biostatistics	2	-	34	-	2	Mathematics
74	Biostatistics	-	1	-	34	1	Mathematics
75	Instrumental Methods of Analysis	3	-	51	-	2	Analytical Chemistry, Organic Chemistry
76	Instrumental Methods of Analysis	-	1	-	34	1	Analytical Chemistry, Organic Chemistry
77	Pharmaceutical Biotechnology	3	-	51	-	3	Molecular Biology and Genetics
Total		89	14			103	

**Note: Practical courses are offered simultaneously with theoretical courses and students are not allowed to take practical courses before theoretical courses.**

**D. Introductory Practice Experience, Advanced Practice Experience and Thesis**

Code	Course Name	Number of Credits		Home				Cred	Prerequisites
		Theoretical	Practical	Theoretical	Practical	practice experience	Advanced practice experience		
78	Urban Pharmacy Introductory Practice Experience					102		2	
79	Hospital Pharmacy Introductory Practice Experience					102		2	
80	Industry Introductory Practice Experience					102		2	Pharmaceutics 5 and pharmacy practical practice
81	Urban Pharmacy Advanced Practical Practice						306	6	-
82	Industry or Hospital Pharmacy Advanced Practice Experience						306	6	-
83	Thesis1		2					2	
84	Thesis2		2					2	Pharmaceutics5
85	Thesis3		4					4	Pharmacy Practical Practice
<b>Total</b>			<b>8</b>			<b>6</b>	<b>12</b>	<b>26</b>	



## E. Elective Courses

Code	Course Name	Number of Credits		Hours		Number of Credits	Prerequisites
		Theoretical	Practical	Theoretical	Practical		
86	Organic Chemistry <sup>3</sup>	3		51		3	
87	Medicinal Chemistry		1		34	1	
88	Instrumental Analysis Methods	2		34		2	
89	Radiopharmacy	2		34		2	Medicinal Chemistry and Pharmacology <sup>2</sup>
90	Drug Control and Analysis	3			51	3	
91	Polymers and Applications in Pharmacy	2		34		2	
92	Pharmaceutics <sup>6</sup>	2		34		2	
93	Biopharmacy and Pharmacokinetics		2		68	2	
94	Modeling in Pharmacokinetics	1	1	17	34	2	
95	Cosmetics		1		34	1	
96		2		51		2	
97	Clinical Pharmacy	2		34		2	
98	Plant Cell Culture (Theoretical)	2		34		2	Pharmacognosy <sup>2</sup>
99	Plant Cell Culture (Practical)		1	34		2	Plant Cell Culture (theoretical)
100	Plant Chemistry	2		34		2	
101	Traditional	2		34		2	Pharmacognos

	Medicine and Supplementar y Medicine						y1,2
Tot al						32	

**COURSE NAME: Mathematics**

**NUMBER OF CREDITS: 3**

**COURSE TYPE: Theoretical**

**PREREQUISITES: -**

### **GENERAL AIMS**

- **Basic knowledge of mathematics**
- **Knowledge of mathematical rules and relations**
- **Enabling students to analyze economic, administrative and accounting issues**

### **COURSE DESCRIPTION**

**A broad knowledge of mathematical sciences is central to proper use of different approaches in pharmaceutical processes and the effect of the resultant drugs; therefore in this course students are taught to use mathematical equations and theories directly related to these processes.**

### **LEARNING OUTCOMES**

**Students must:**

- **have basic knowledge of functions**
- **know all types of functions**
- **know the definitions and properties of limit**
- **be able to use differential calculus**
- **know the functions of differential calculus**
- **know integral calculus**

## **CONTENT**

- **Group theory: principles and main manipulations of member groups**
- **Functional relations: relations of all functions**
- **Limit, definition and characteristics**
- **Primary function and integral calculus**

## **SOURCES**

**Differential and integral calculus and analytical Geometry**

## **ASSESSMENT METHOD:**

- 1. Essay type test: 70%**
- 2. Team work results: 30%**

**COURSE NAME: Physics**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Theoretical**

**PREREQUISITES: -**

### **GENERAL AIMS**

**Acquiring knowledge on how to use physics in pharmacy and how to use different radiation machines and their relation with pharmaceutical sciences**

### **COURSE DESCRIPTION**

**Due to the direct relationship between physical laws and pharmaceutical sciences this course helps increase student knowledge.**

### **LEARNING OUTCOMES**

**Students must:**

- **Have knowledge of optics**
- **Know different ionizing radiations including radioactive rays, biological zayat and how to protect against ionizing radiation.**
- **Know medical imaging methods**

### **CONTENT**

- 1. Optics**
  - a. Electromagnetic radiation and light polarization**
- **light magnetic theory, new light theory**
- **Polarization**
- **Polarization through reflection and double refraction**

- **Nicole's prism and Brewster's laws**
- **Polaroid**
- **Biot's laws in polarimetry**

**b. Wave optics**

**c. Laser**

- **Introduction to laser**
- **Laser production**
- **Use of laser in medical sciences**

**2. Neurophysics**

**a. Particular optic specifications**

- **Photoelectric effect**
- **Einstein's photon theory**
- **Compton effect**
- **Atomic models**
- **Bohr hydrogen atomic model**

**b. Waves and particles**

- **Atomic structure and vertical standing waves**

**3. Liquids**

- **Surface tension**
- **The effect of intermolecular forces**
- **Bernoulli's Law**
- **Torricelli's Law**
- **Viscosity**
- **Reynolds number**
- **Poisson's Equation**

**4. Ionizing radiations**

**a. X-Ray**

- **Different kinds of ionizing rays and comparisons between them.**
- **Radiation physics and physiology**
- **X-Ray production**
- **X-Ray spectrum**
- **Inverse-square Law**
- **X-Ray absorption and attenuation coefficient**
- **Half-value Layer ( HVL) and TVL**

**b. Radioactivity**

- Half life
- Activity
- Mean life
- Total Emitted Radiation
- The relation between protons and neutrons in nucleus
- Radioactive rays
- Alpha decay
- Use of radioisotopes
- Use of radioisotopes as sources for ionizing radiation production in radiology and radiotherapy and linear energy transmission (LET)
- Biological side effects of ionizing rays (radiobiology)
- Definition and scopes of the science of radiobiology
- Cell and cell types
- Radiation absorption
- Radiation effects on cell and tissue
- Types of cell biological changes after exposure to and absorption of radiation
- Ionizing radiation protection
- Intro and definition
- organizations
- hazards and profits
- three main principles of protection
- dosages and units in protection
- maximum permissible dosage
- X-Ray and pregnancy
- 5. General physical laws and medical imaging
  - Radiography X and CT
  - Radiomedicine a, PET and SPECT
  - MIR
  - Ultrasound and its use in medicine and pharmacy.....

## **SOURCES**

Medical Physics; last edition

## **ASSESSMENT METHOD**

- Multiple choice and essay type final exams 80%
- Report and oral presentation 20%

**COURSE NAME: Physics**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: -**

### **GENERAL AIMS**

- **Acquiring knowledge of lab equipment**
- **Acquiring knowledge of measurement rules and techniques**
- **Acquiring knowledge of measurement equipment and determining applications in medical and pharmaceutical sciences**

### **COURSE DESCRIPTION**

**Putting the theoretically learned material is the main objective of this course**

### **LEARNING OUTCOMES**

**Students must know how to use refractometry, polarimetry and calorimetry devices**

### **CONTENT**

**Pharmaceutical physics experiments:**

- **Refractometry**
- **Polarimetry**
- **spectoscopy**
- **calorimetry**
- **Viscosity, surface tension**
- **pH meter**
- **Measurement and error analysis**
- **Bernoulli's Law**



## **SOURCES**

**Medical Physics**

## **ASSESSMENT METHOD**

- **Field work reports 80%**
- **Work report 20%**

**COURSE NAME:** General Chemistry

**NUMBER OF CREDITS:** 4

**COURSE TYPE:** Theoretical

**PREREQUISITES:** -

### **GENERAL AIMS**

- Familiarizing students with chemical laws and calculations
- Familiarizing students with Atom structure
- Familiarizing students with chemical and kinetic equations and thermodynamic reactions

### **COURSE DESCRIPTION**

The principles of matter properties including liquid, solid and gas phases and metals and the general laws of these matter phases are taught in this course, and this knowledge is used as a foundation in pharmaceutical sciences.

### **LEARNING OUTCOMES**

Students must:

- Know and be able to explain chemical concepts and calculations
- Be able to use these concepts in understanding chemical phenomena
- Be able to solve and analyze theoretical and practical problems in chemistry
- Know the different chemical and inter-molecular bonds
- Know the laws of solutions
- Know all chemical and kinetic equivalences, chemical reaction degrees and speed

### **CONTENT**

1. The basic concepts of measurement in chemistry ( mass, density, ...)
2. Chemical bonds and molecular orbitals
3. Complexes
4. Gasses
5. Liquids
6. Solids

7. Solutions and the related rules
8. Halogens
9. Nitrogen and compounds
10. Sulfur and compounds
11. Metal groups 1<sup>st</sup> to 5<sup>th</sup> and their important characteristics
12. Chemical equivalences
  - Chemical equivalence writing methods
  - The effect of different factors on equivalences
  - Calculating equivalence constant
  - Concentration calculation
  - Equivalences in heterogeneous medium
13. Chemical kinetics
  - Reaction kinetics
  - Kinetic theory
  - The effect of different factors on reaction speed
  - Reaction degree
  - Reactions and the speed of reaction type 1 and 2
14. Acids and bases, salts and solubility
15. Thermodynamics
16. Electro chemistry

## SOURCES

1. Mortimer, C.E. Last Edition
2. Atkins, P.W. General Chemistry, Last Edition
3. Mortimer Chemistry, University Publications

## ASSESSMENT METHOD

- Essay type exam 30%
- Multiple choice exam 50%
- Class work 10%
- Oral presentation 10%

**COURSE NAME: General Chemistry**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Practical**

**PREREQUISITES: -**

### **GENERAL AIMS**

**Acquiring the required skills to use lab equipment and recognizing materials through their physical characteristics**

**Recognizing and categorizing cation compounds and doing all oxidation and reduction reactions**

### **COURSE DESCRIPTION**

**Learning different methods to determine the physical characteristics of materials and approaches of complex preparation and performing oxidation and reduction reactions are covered in this course.**

### **LEARNING OUTCOMES**

**Students must:**

- **Know the equipment in general chemistry lab**
- **Know the approaches to measure density, boiling point and melting point.**
- **Know complex production methods**
- **Be able to identify materials using analytical reactions**
- **Know cation classifications and identification methods**
- **Know different oxidation and reduction methods**

### **CONTENT**

- 1. Knowing lab equipment**
- 2. Identifying materials using :**
  - **Solubility**
  - **Density**
  - **Boiling points**
- 3. Gasses constant determination**

4. liquids purification methods
5. complexation reaction
6. preparation of halogens
7. recognizing and categorizing cations
8. recognizing ions
9. finding the most suitable solvent
10. basic melt
11. oxidation and reduction reactions
12. equivalence constant determination

## **SOURCES**

1. Mortimer, CE. Last Edition
2. Atkins, P.W. General Chemistry
3. Mortimer Chemistry, university publications

## **ASSESSMENT METHOD**

- lab activity and result report 80%
- work report 20%

**COURSE NAME:** Molecular Biology and Genetics

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** -

### **GENERAL AIMS**

**Familiarizing students with:**

- The concepts and functions of cell structure and physiology in molecular biology (learning about primary and advanced cells)
- The principles of Genetics
- Molecular immunology
- Basic principles of DNA technology

### **COURSE DESCRIPTION**

Because of the progress made in pharmaceutical sciences at molecular level and the central role of Genetics in drug preparation, this course provides students with the required knowledge.

### **LEARNING OUTCOMES**

**Students must:**

1. know the functions of different metabolic cycles in cells
2. know the functions of different cell organelles in Genetics
3. know cell structure
4. know concepts of cell mutation
5. know how to control cell activity

### **CONTENT**

- History of molecular biology and genetics.
- The significance of genetics.

- **A review of Nucleic acids and gene structure**
- **Review of DNA amplification**
- **Review of DNA replication**
- **Transcription process in protein synthesis**
- **Methods of gene activity control**
- **Molecular immunology and antibody genetic basics.**
- **Types and structure of antibodies.**
- **Types of mutation( methods of mutation creation)**
- **Knowing teratogens, carcinogens, mutagens.**
- **Molecular basics of cancers**
  - a. **Different stages of cancers**
  - b. **Genetic aspects of cancers**
  - c. **Cancer mechanism- genetics**

## **SOURCES**

- **Walker, J.M. and Gingold, E.B, Molecular Biology and biotechnology. Royal society of Chemistry, London (1993)**

## **ASSESSMENT METHOD:**

- **Multiple choice exam 30%**
- **Essay type exam 40%**
- **Translation of articles and books**
- **Team work results**

**COURSE NAME:** Anatomy and Histology

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** -

### **GENERAL AIMS**

- Familiarizing students with basic principles and concepts of general anatomy and nerve anatomy
- Familiarizing students with different body cells and epithelial and connective tissues

### **COURSE DESCRIPTION**

Knowing the different body parts and tissues affect the way we understand the effect of drugs, and therefore it is taught in this course.

### **LEARNING OUTCOMES**

Students must:

1. Know human anatomy
2. Know and be able to interpret the functions of the nervous system
3. Know different human tissues from cellular and microscopic aspects

### **CONTENT**

1. General anatomy and histology and intro
2. Bone and joint anatomy
3. Muscle anatomy
4. Anatomy of the respiratory and the cardiovascular systems
5. Anatomy of the urogenital system
6. Anatomy of the spinal cord and the peripheral nerves
7. Anatomy of midbrain
8. Definition of the cell and cell components
9. Epithelial tissues, connections and functions



**10. Connective tissues**

**11. Histology of**

- **Peripheral nerve systems**
- **Central nerve system**
- **Blood circulatory system**
- **The immune system**
- **Lymphatic glands**
- **The gastrointestinal tract**
- **The respiratory system**
- **The urinary system**
- **The eye**
- **The ear**

**SOURCES**

**Gray's anatomy, last edition**

**Histology basics, Dr. Noori and Dr. Minaei**

**ASSESSMENT METHOD:**

**Multiple choice and essay type test**

**COURSE NAME:** Anatomy and Histology

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Practical

**PREREQUISITES:** -

### **GENERAL AIMS**

- Familiarizing students with basic principles and concepts of general anatomy and nerve anatomy
- Familiarizing students with different body cells and epithelial and connective tissues

### **COURSE DESCRIPTION**

Using the theoretical learnings, familiarization with cadaver anatomy and different body tissues using microscope and slides are of the topics covered in this course.

### **LEARNING OUTCOMES**

Students must:

- Know human body structure
- Be able to analyze system functions, particularly the nervous system
- Know different body functions from cellular and microscopic aspects

### **CONTENT**

1. Knowing the Museum of Anatomy
2. Knowing the osteology museum
3. Knowing the anatomy hall
4. Knowing body parts through anatomy and slides
5. Knowing different body tissues including
  - peripheral nerves
  - Central nerves
  - The circulatory system
  - The immune system
  - Lymphatic glands

- **The gastrointestinal tract**
- **The respiratory system**
- **The urinary system**
- **The eye**

## **SOURCES**

**Gray's Anatomy, last edition, or Dr. Bahram Elahi Anatomy**

**General Concepts in Histology, Dr. Noori and Dr. Minaei**

## **ASSESSMENT METHOD**

**Recognizing body parts and lams related to different tissue types 90%**

**Work report 10%**

**COURSE NAME:** Analytical Chemistry

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** General Chemistry

### **GENERAL AIMS**

Familiarizing students with the principles of chemical matter quantification in mixtures, using chemical methods

### **COURSE DESCRIPTION**

Analysis and identification of the component and quantification of materials are among important topics in pharmacy, which are covered in this course.

### **LEARNING OUTCOMES**

Students must:

- Know different methods to quantify chemicals
- Know how to quantify organic compounds using different methods
- Know different methods of titration

### **CONTENT**

1. Intro, definition
2. Errors and statistical processing of data
3. Acid-Base assessment (in aqueous and non-aqueous media), drawing of curves and indicator evaluation.
4. Mixture quantification (acids, bases, salts)
5. Kjeldahl method
6. Quantification of organic compounds, using chemical methods (nitrogen compounds, alcohols and esters)
7. Precipitate evaluation

8. Complex evaluation
9. Oxidation-reduction evaluation
10. Gravimetric titration

## **SOURCES**

**Concepts of Analytical Chemistry**

## **ASSESSMENT METHOD**

1. Group work 30%
2. Final exam (essay type and problem solving) 70%

**COURSE NAME:** Analytical Chemistry

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Practical

**PREREQUISITES:** General Chemistry

### **GENERAL AIMS**

Performing experiments and learning the common methods to identify and quantify different compounds.

### **COURSE DESCRIPTION**

Presenting quantitative methods to measure compounds and accurate approaches to prepare solutions.

### **LEARNING OUTCOMES**

Students must:

1. Different methods to standardize solutions
2. Different methods of titration and compound quantification.

### **CONTENT**

Each session:

1. Distribution of lab equipment among students and assigning work area, general advice on correct work methods, quantification and preparation of standard sodium hydroxide solution 0.1 and standard 0.1 chloridric acid solution.

### **SOURCES**

Principles of Analytical Chemistry, skoog- west. 1<sup>st</sup> volume

Translator: Hooshang Khalili

Publication: University Publication Center

## **ASSESSMENT METHOD**

**Midterm exam, final exam**

- 1. Experiments and presenting results: 80%**
- 2. Final exam: 20%**

**COURSE NAME:** Organic Chemistry 1

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** General Chemistry

### **GENERAL AIMS**

1. Familiarizing students with the Characterizations of Organic materials Classifications, naming and synthesis reactions and the reaction of each organic matter group.
2. Utilizing the aforementioned concepts to learn the principles of pharmaceutical sciences and organic materials analysis to be used in pharmacology medicinal chemistry, formulations of pharmaceuticals and qualifications and quantifications of them.

### **COURSE DESCRIPTION**

In this course classifications, naming systems and the physicochemical characteristics of different organic functional groups and their synthesis routes are taught.

### **LEARNING OUTCOMES**

Students must

1. Be able to classify and name organic materials and know the physical and chemical characterizations of each group.
2. Be able to explain synthesis processes of each of the organic material group and the related reaction mechanisms.
3. Use the learned concepts to better understand the mechanisms of drug effects (in pharmacology and medicinal chemistry) and to prepare drug formulations and quantifications and qualifications of them



## CONTENT

### Intro

- Acids and bases:

Alkanes: classification, Nomenclature, conformations, organic metal compounds, radical Halogenation reactions, Radical stability.

- Stereochemistry(1):

The concept of chirality, optical isomers, geometric isomers, diastereomers, enantiomers, reactions, chiral compound reactions...

- Stereochemistry(2)

Stereo selective and stereospecific reactions, stereochemistry and alkene addition reactions, E<sub>2</sub> reactions, Cis and Anti reduction...

- Alkyl Halides:

Substitution reactions SN<sub>1</sub> and SN<sub>2</sub>, Carbocation types and their relative stability

- Alcohols:

Alcohol preparations, reactions of alcohols with hydrogen halides, alcohol oxidations...

- Ethers:

Synthesis of ethers

- Role of solvents:

Classifications of solvents based on proticity and polarity, suitable solvent for SN<sub>1</sub> and SN<sub>2</sub> reactions, role of the medium in the type of substitution and reduction reaction ...

- Alkenes (1):

E-Z isomerism, elimination reactions of alkyl halides and their mechanisms ...

- Alkenes(2):

Alkene reactions, hydrogenation, electrophilic additions, oxymercuration reactions, demercuration and hydroboration, radical oxidation and reductions...

- Resonance and coupling:

Resonance theory and its use to justify radical and allylic carbocation stability, their reactivity in substitution and radical reactions ...

- Alkynes:

Alkyne preparation, electrophilic adding and reduction reactions...

- Aliphatic compounds:

Reaction preparation, cyclohexane conformations, axial tropical bonds, stereo isomers....

## SOURCES

1. Morrison, R.T. Boyd, R.N, Organic Chemistry 5<sup>th</sup> ed.; Allyn and Bacon, Inc.; 1987
2. Bacon, J.D.; Caserio, M.C.; Basic Principles of Organic Chemistry; 2<sup>nd</sup>ed.;W.A. Benjamin, Inc.; 1977.
3. Ege, S.N.; Organic Chemistry; 2<sup>nd</sup>ed,; D.C Health and Company; 1989
4. Wade, L.G.; Organic chemistry 2<sup>nd</sup> ed.; prentice-Hall, Inc.;1991

## ASSESSMENT METHOD

1. Essay type test: 50%
2. Oral presentation: 10%
3. Evaluation test: 40%

**COURSE NAME: Organic Chemistry 1**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: General Chemistry**

### **GENERAL AIMS**

**Familiarizing students with different methods to extract and purify compounds.**

### **COURSE DESCRIPTION**

**Different methods of purification and extraction are covered in this course.**

### **LEARNING OUTCOMES**

**Student must:**

- 1- Know purification methods**
- 2- Know extraction methods**

### **CONTENT**

- **Determining physical constants including melting points, boiling points, density and refractive index.**
- **Separation and purification of organic compounds.**
- **Simple distillation**
- **Vacuum distillation**
- **Distillation with water vapor**
- **Re-crystallization**
- **Extraction using organic solvents**
- **chromatography**

### **SOURCES**

- 1. Morrison, R.T. Boyd, R.N, Organic Chemistry 5<sup>th</sup> ed.; Allyn and Bacon, Inc.; 1987**
- 2. Bacon, J.D.; Caserio, M.C.; Basic Principles of Organic Chemistry; 2<sup>nd</sup> ed.; W.A. Benjamin, Inc.; 1977.**

3. Ege, S.N.; Organic Chemistry; 2<sup>nd</sup> ed.,; D.C Health and Company; 1989
4. Wade, L.G.; Organic chemistry 2<sup>nd</sup> ed.; prentice-Hall, Inc.;1991

#### **ASSESSMENT METHOD**

1. Essay type test: 50%
2. Multiple choice test: 40%
3. Oral presentation: 10%

**COURSE NAME:** Organic Chemistry 2

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Organic Chemistry 1

**GENERAL AIMS:**

4. Familiarizing students with the Characterizations of Organic materials Classifications, nomenclature, synthesis reactions and the reaction of each organic matter group.
5. Utilizing the aforementioned concepts to learn the principles of pharmaceutical sciences and organic materials analysis to be used in pharmacology medicinal chemistry, formulations of pharmaceuticals and qualifications and quantifications of them.

**COURSE DESCRIPTION**

Methods of classifications and naming different compounds such as aliphatic and aromatic compounds and carboxylic acids are covered in this course.

**LEARNING OUTCOMES:**

Students must

6. Be able to classify and name organic materials and know the physical and chemical characterizations of each group.
7. Be able to explain synthesis processes of each of the organic material group and the related reaction mechanisms.
8. Use the learned concepts to better understand the mechanisms of drug effects (in pharmacology and medicinal chemistry) and to prepare drug formulations and quantifications and qualifications of them

## CONTENT

- **Aromaticity:**

Aromaticity concepts, Huckle's Rule, aromatic and anti-aromatic compounds, aromatic multinuclear hydrocarbons...

- **Aromatic electrophilic substitution:**

The effect of substitution groups in reactivity, nitration and sulfonation mechanisms, Friedel-Crafts Alkylation, halogenation mechanism...

- **Aromatic aliphatic compounds:**

Reaction preparation, the effect of the aromatic ring on reactions, benzyl radical stability, 3-phenylmethyl as a stable free radical, benzyl cation stability ...

- **Aldehydes and Ketones:**

Preparation of nucleophilic adding reactions of the Carbonyl group...

- **Carboxylic acids:**

Preparation methods, the effect of substitution on acid strength, Alpha Halogenation...

- **Carboxylic acid derivatives:**

Nucleophilic Acyl substitution, preparation of reactions of acyl chlorides, Esters, Amides ...

- **Functional derivatives of carboxylic acids:**

Esters, amides, nucleophilic acyl substitution, acyl chloride reactions...

- **Amines:**

Nitrogen stereochemistry, reduction of nitro compounds, Reductive amination, Hoffman Rearrangement

- **Amines**

The effect of substitution on amine basic power, Hoffman reduction...

## SOURCES

1. Morrison, R.T. Boyd, R.N, Organic Chemistry 5<sup>th</sup> ed.; Allyn and Bacon, Inc.; 1987
2. Bacon, J.D.; Caserio, M.C.; Basic Principles of Organic Chemistry; 2<sup>nd</sup> ed.; W.A. Benjamin, Inc.; 1977.

3. Ege, S.N.; Organic Chemistry; 2<sup>nd</sup>ed,; D.C Health and Company; 1989
4. Wade, L.G.; Organic chemistry 2<sup>nd</sup> ed.; prentice-Hall, Inc.; 1991

#### **ASSESSMENT METHOD**

- 1- Essay type test 90%
- 2- Oral presentation 10%

**COURSE NAME:** Organic Chemistry 2

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITES:** Organic Chemistry 1

### **GENERAL AIMS**

To practically familiarize students with synthesis methods of organic compounds and use of specific reactions for synthesis.

### **COURSE DESCRIPTION**

Methods of identification and synthesis of compounds and functional groups will be covered in practice.

### **LEARNING OUTCOMES**

Students must:

1. Be able to identify functional groups
2. Know the common methods of compound synthesis

### **CONTENT**

- 1- Elemental analysis
- 2- Identification of functional groups
- 3- Acetylation reactions ( Aspirin and acetanilide)
- 4- acetanilide nitration
- 5- Benzoic acid preparation
- 6- Esterification
- 7- Catalyst reaction

### **SOURCES**

1. Morrison, R.T. Boyd, R.N, Organic Chemistry 5<sup>th</sup> ed.; Allyn and Bacon, Inc.; 1987



2. Bacon, J.D.; Caserio, M.C.; Basic Principles of Organic Chemistry; 2<sup>nd</sup> ed.; W.A. Benjamin, Inc.; 1977.
3. Ege, S.N.; Organic Chemistry; 2<sup>nd</sup> ed.; D.C Health and Company; 1989
4. Wade, L.G.; Organic chemistry 2<sup>nd</sup> ed.; prentice-Hall, Inc.; 1991

#### **ASSESSMENT METHOD**

1. Essay type test 50%
2. Multiple choice test 40%
3. Oral presentation 10%

**COURSE NAME: Fundamental Biochemistry**

**NUMBER OF CREDITS: 3**

**COURSE TYPE: Theoretical**

**PREREQUISITES: -**

### **GENERAL AIMS**

**Familiarizing students with:**

- 1- Raw materials building micro molecular structures**
- 2- Different biochemical mechanisms**
- 3- Biochemical catalysts and vitamins and their functions in biochemical processes**
- 4- Regulating factors of biochemical reactions and the central role of hormones**

### **COURSE DESCRIPTION**

**The chemical structure of organic matters existing in human body, including carbohydrates, proteins, lipids and other compounds with significant functions in body, such as hormones, vitamins and enzymes will be examined in this course.**

### **LEARNING OUTCOMES**

**Students must:**

- 1. Know the structure of carbohydrates , lipids, nucleic acids and fats**
- 2. Know the metabolisms of carbohydrates, lipids, fats and proteins**
- 3. Know proteins, and nucleic acids biosynthesis paths**
- 4. Know the structures and characterizations of vitamins and hormones**
- 5. Know the catalyzing function of enzymes**

### **CONTENT**

- 1. Intro to biochemistry**
- 2. Cell structure and the function of its organelles in biochemical processes**
- 3. The chemical structure of organic compounds existing in human body, including:**
  - a. Water and biological buffers**
  - b. carbohydrates**
  - c. Lipids**

- d. Proteins
- e. Enzymes and vitamins
- f. Nucleic acids
- g. Hormone structure
- 4. Biosynthesis
  - a. Nucleic acids
  - b. Proteins
- 5. Bioenergetics and biologic oxidation

## **SOURCES**

1. Biochemistry; Maleknia- Shahbazian
2. Lehninger Biochemistry
3. Stryer Biochemistry

## **ASSESSMENT METHOD**

**Mid-term and final multiple choice tests 100%**

**COURSE NAME: Fundamental Biochemistry**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: -**

### **GENERAL AIMS**

- Familiarizing students with carbohydrates, fats and protein quantifications
- Familiarizing students with different kinds of biochemical tests and factors and materials quantifications

### **COURSE DESCRIPTION**

Methods to identify significant compounds and the use of different devices to measure important factors are the topics covered in this course.

### **LEARNING OUTCOMES**

Students must:

1. Know the methods to quantify carbohydrates
2. Know the methods to identify and quantify proteins
3. Know how to use the required devices to measure biochemical factors

### **CONTENT**

1. Distribution of lab equipment between work groups, explanation about the equipment and the safety measures related to lab work
2. Different solution concentration units, titration
3. Carbohydrate tests(1) : Molisch's test, Benedict
4. Carbohydrate tests(2): Barfoed's test
5. Carbohydrate chromatography; urine glucose test using Benedict's method
6. Amino acid identification( Ninhydrin test, Xantoproteic reaction, Millon, sulfur)
7. Lipid analysis, emulsion test, Salkovsky's test)
8. Urine complete test, part one  
Intro to urine, creatinine tests, urinary sulfate, glucose, protein...

9. Urine complete test, part two
  - Identification of blood in urine

## **SOURCES**

1. Biochemistry Lehninger
2. Biochemistry Devlin
3. Biochemistry Stryer

## **ASSESSMENT METHOD**

1. Experiments and work report 60%
2. Practical test 40%

**COURSE NAME:** Physiology 1

**NUMBER OF CREDITS:** 4

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Biochemistry and Anatomy

### **GENERAL AIMS**

Familiarizing students with physiology of the cardiac muscle, blood circulation, respiration, the gastrointestinal tract and blood physiology.

### **LEARNING OUTCOMES**

Because learning about body actions and physiology of different body parts is central to knowing the mechanisms of drug effects, students will study the respiratory and the circulatory systems and the gastrointestinal tract in this course.

### **COURSE DESCRIPTION**

Students must:

1. Know the cell and the surrounding media
2. Know the properties of the HEART CELL, electrocardiography and the laws related to the electrical pulses of the heart.
3. Know blood circulation physiology
4. Know the anatomophysiology of the respiratory system
5. Know the actions and functions of the gastrointestinal tract

### **CONTENT**

1. Physiology of the cell and the surrounding media
  - Hemostasis , fluid compartment, the physiology and structure of the cell membrane, transport mechanisms, comparison between cardiac a, nervous and muscle action potentials
2. Physiology of the cardiac muscle
  - Anatomophysiology of the heart, heart mechanics(systole, diastole, cardiac cycle), cardiac sounds, the effect of ions and hormones on the heart, electrocardiography, electrocardiogram derivatives, electrocardiogram derivative axes

### **3. Physiology of blood circulation**

- Hemodynamics ( vascular resistance, viscosity, vascular blood circulation, blood pressure...), arterial pulses, physiology of arterioles, mean arterial pressure, methods of arterial pressure measurement and ...

### **4. Physiology of respiration**

- Anatomico-physiology of the respiratory system, respiration mechanics, rib cage elasticity, the role of surfactant, respiratory action...

### **5. Physiology of the gastrointestinal tract and metabolism**

### **6. Physiology of Arterial blood regulation**

- PH definition, Henderson Hasselbalch equation, acidose types, the effect of blood buffers, intracellular buffers, the role of the respiratory system in PH regulation

### **7. Physiology of blood**

## **SOURCES**

**Guyton Physiology; last edition.**

## **ASSESSMENT METHOD**

- 1. Essay type and multiple choice test 80%**
- 2. Oral presentation 20%**

**COURSE NAME:** Physiology 2

**NUMBER OF CREDITS:** 4

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Physiology 1

### **GENERAL AIMS**

- Familiarizing students with the endocrine glands and the urogenital system.
- Familiarizing students with the role of the kidney in regulating body fluids.
- Familiarizing students with the nervous system

### **COURSE DESCRIPTION**

The functions of the endocrine and exocrine glands, the kidney and the nervous system are of great importance in understanding drug effect mechanisms in these systems, therefore these topics will be covered in this course.

### **LEARNING OUTCOMES**

Students must:

1. Know the functions of the endocrine glands.
2. Know the functions of exocrine glands.
3. Know the functions of the kidney and the body fluid regulating systems.
4. Know the nervous system and the functions of each part.

### **CONTENT**

1. Physiology of the endocrine glands and the genital system
  - Introduction to hormones and their function mechanisms, physiology of the adenohypophysis and neurohypophysis glands, the relation between pituitary gland and the hypothalamus, physiology of the thyroid gland, physiology of the parathyroid gland and calcium metabolism, the pancreatic, physiology of the ovaries, physiology of the menstrual cycle, physiology of pregnancy and placenta, physiology of menopause.
2. Physiology of the kidney and body liquid regulation



- **Anatomo-physiology of the kidney, renal blood circulation, nephron structure, glomerular filtration and measurement, plasma clearance...**
  
- 3. Physiology of the nervous system**
  - a. **Mid-brain physiology- balance, movement and position control physiology- thalamus physiology- learning, memory and conditional reflexes- limbic system-autonomic nervous system- brain waves- body temperature regulation- cerebrospinal liquid- eye physiology- ear physiology- brain blood.**
- 4. Physiology in sports**
- 5. Physiology in special conditions: infancy, old age, pregnancy**

## **SOURCES**

**Guyton Physiology; last edition.**

## **ASSESSMENT METHOD**

- 1. Essay type and multiple choice test 80%**
- 2. Team work and oral presentation 20%**

**COURSE NAME: Physiology 2**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: Physiology1**

### **GENERAL AIMS**

- Achieving a better understanding of physiological concepts after lab observations
- Performing some of the most common tests such as red cell count and hematocrit
- Learning how to use equipment like otoscope to diagnose diseases.

### **COURSE DESCRIPTION**

Performing common para-clinic tests and the effects of some compounds on different organs are covered in this course.

### **LEARNING OUTCOMES**

Students must:

- Do some clinic and paraclinic tests
- Know environmental and chemical stimulations

### **CONTENT**

- RBC count and introduction to microscope
- WBC count
- DIFF count
- HCT, HGB
- BT, CT, PT
- Blood pressure and heart sound examination in different physiological situations and the effects of sports on them
- EKG
- Introduction to EEG, EMG
- Introduction to otoscope and ophthalmoscope
- Renal perfusion

- **Liver perfusion**
- **Suggested complementary topics**  
**Examination of frog spinal reflexes**

## **SOURCES**

**Guyton Physiology; last edition**

## **ASSESSMENT METHOD**

- 1. Teamwork 60%**
- 2. End-of-term test performing 40%**

**COURSE NAME:** First Aid and Introduction to Medical Equipment

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** 1 theoretical - 1 practical cred

**PREREQUISITES:** -

### **GENERAL AIMS**

Familiarizing students with first aids principles, resuscitation approaches, hemorrhage control, poisonings and emergencies in poisonings.

### **COURSE DESCRIPTION**

A high command of different body functions is crucial in emergencies, therefore different methods to resuscitate and cope with emergencies like burns and bleedings and the use of different medical devices are covered in this course.

### **LEARNING OUTCOMES**

Students must:

- Know the importance of first aids
- Know different methods of cardiac and respiratory resuscitation
- Know different methods to control hemorrhages
- Know patient transport methods
- Know the use of different medical equipment
- Know different types of poisoning

### **CONTENT**

1. The importance of first aids
2. Know different kinds of respiratory and cardiac arrest and resuscitation
3. The effects of cardiac- respiratory resuscitation
4. Wounds, bleedings and trauma caused by accidents
5. How to control hemorrhages
6. Different kinds of poisoning and symptoms
7. Different kinds of burn

## **8. Medical equipment**

### **SOURCES**

**Principles of First Aids; last edition**

**Britain Red Cross, Guide to First Aids**

**Translator: Samimizad**

### **ASSESSMENT METHOD**

- 1. Final exam 50%**
- 2. Practical performance of the methods 50%**

**COURSE NAME: Microbiology**

**NUMBER OF CREDITS: 3**

**COURSE TYPE: Theoretical**

**PREREQUISITES: Molecular Biology and Genetics**

### **GENERAL AIMS**

- 1. Learning the principles of microbiology, including the structural and physiological properties of microorganisms and their roles in diseases and the methods to control them.**
- 2. Classification of pathogens**
- 3. Treatment of bacterial diseases**

### **COURSE DESCRIPTION**

**The principles of microorganism classification and the mechanisms of antimicrobial drugs**

### **LEARNING OUTCOMES**

**Students must:**

- 1. Know microbial and physiological principles**
- 2. Know the methods and problems of microorganism classification**
- 3. Know pathogenic and epidemiological mechanisms**
- 4. Know antiseptic effect mechanisms**
- 5. Know control methods the mechanisms of antibiotic effects**
- 6. know the methods to determine the effect mechanisms of antibiotics**
- 7. Be able to explain the relationship between dosage, parasite and the drug.**
- 8. Know protection methods while working with microorganisms**
- 9. Know methods to work with microorganisms, microscope use and microscopic and macroscopic identification of microorganisms**
- 10. Be able to do cell culture and perform identification experiments**
- 11. Perform antibiogram tests and know and examine antibiotic effects**

## **CONTENT**

- 1. An introduction to microbiology**
- 2. Classifications of microorganisms**
- 3. Microorganism growth and death and the related rules**
- 4. Microorganism metabolism**
- 5. Microorganism genetics**
- 6. The relations of microorganisms and host**
- 7. Antibiotics: classifications and mechanisms**
- 8. Streptococcus**
- 9. Gram-positive bacilli**
- 10. Gram-negative bacilli**
- 11. Pseudomonas**
- 12. vibrionaceae**
- 13. Enterobacteriaceae**
- 14. Gram-negative cocci**
- 15. Mycobacterium**

## **SOURCES**

**Jawetz Microbiology; last edition**

## **ASSESSMENT METHOD**

- 1. Essay type test 90%**
- 2. Oral presentation 10%**

**COURSE NAME: Microbiology**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: Molecular Biology and Genetics**

### **GENERAL AIMS**

**Familiarizing students with the structure of microorganisms, staining, lam preparation**

### **COURSE DESCRIPTION**

**Methods of identifying, culture and staining of microorganisms are covered in this course.**

### **LEARNING OUTCOMES**

**Students must:**

- 1. Know microbiology lab equipment**
- 2. Know staining methods**
- 3. Be able to prepare culture medium**
- 4. Know microorganism identification methods**

### **CONTENT**

- 1. Knowing microbiology lab equipment and lam preparation**
- 2. Gram stain**
- 3. Spore stain**
- 4. Capsule stain**
- 5. Albert's stain**
- 6. Staining of mast cell acid**
- 7. Performing antibiogram**
- 8. Identification of staphylococcus, streptococcus, pneumococcus using different tests: catalase, coagulase, mannitol salt agar, Dnase, phosphatase, pigment test, hemolysis**
- 9. Pneumococcus: hemolysis, optochin**



## **SOURCES**

**Jawetz Microbiology**

## **ASSESSMENT METHOD**

- 1. Multiple choice test 60%**
- 2. Seminar 10%**
- 3. Lab work report 30%**

**COURSE NAME: Virology**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Theoretical**

**PREREQUISITES: Simultaneously with Microbiology**

### **GENERAL AIMS**

- Familiarizing students with the principles and classifications of virology
- Familiarizing students with different kinds of pathogenic viruses

### **COURSE DESCRIPTION**

Due to the role and importance of viruses in pharmacy, and their significance in genetics, virus classifications and viral diseases are the main objectives of this course.

### **LEARNING OUTCOMES**

Students must:

1. Know virus classifications
2. Know Picornavirus, pax virus, rabies, hepatitis and cancer causing viruses.

### **CONTENT**

- Principles of virology
- Viruses of the herpes group
- Picornaviruses
- AIDS virus
- Pax viruses
- Adenoviruses
- Arboviruse
- Hepatitis viruses
- Rabies viruses
- Cancer causing viruses

## **SOURCES**

**Jawetz Microbiology**

## **ASSESSMENT METHOD**

- 1. Essay type test 90%**
- 2. Oral presentation 10%**

**COURSE NAME:** Parasitology and Mycology

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Molecular Biology and Genetics

### **GENERAL AIMS**

Familiarizing students with parasites and fungi classifications, their life cycles, diagnosis of fungal and parasitic diseases and different kinds of pathogenic parasites and fungi.

### **COURSE DESCRIPTION**

Due to the variety of anti-parasitic drugs and the different drug effect mechanisms, learning different methods to classify parasites and their lifecycles are crucial to a pharmacist.

### **LEARNING OUTCOMES**

Students must:

1. Know parasite classifications.
2. Know fungus classifications.
3. Know fungal and parasitic diseases.

### **CONTENT**

1. protozoa
  - Human malaria parasites (*plasmodium vivax*, *plasmodium falciparum* and malaria), *toxoplasma gondii*, *sarcocystis*, *isospora hermitis* and *belli*, amoebae...
2. worms
  - Trematodes (*schistosoma* and other pathogenic trematodes), cestodes (*echinococcus*, *tenias*, *cyst hydatic*, *dipylidium*), nematodes (*ascaris*, hookworms...)
3. arthropods
  - Lice (*pediculus humanus* and *phthirus pubis*), *cimex*, *lectularius*, *triatoma*, *xenopsylla cheopis*.
4. Fungi

- Saprophytic fungi (Penicillium, aspergillus, mucor, cladosporium, scopulariopsis, streptomycesrhodotorula), malassezia furfur, carnobacterium, mocoro candida, ecthothrix, endothrix, trichophyton, epidermophyton.

## **SOURCES**

Medical Parasitology; Dr. Brown. Last translation

Medical Parasitology; dr. wog .last edition

## **ASSESSMENT METHOD**

1. Multiple choice test 90%
2. Oral presentation 10%

**COURSE NAME:** Parasitology and Mycology

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITES:** Molecular Biology and Genetics

### **GENERAL AIMS**

- Familiarizing students with protozoan diseases.
- Familiarizing students with techniques to separate parasites from blood and fecal sample

### **COURSE DESCRIPTION**

Methods to identify parasites, larvae and fungi will be taught.

### **LEARNING OUTCOMES**

Students must:

1. Be able to separate protozoa from blood and fecal and tissue samples
2. Know how to separate larvae, worm and parasite from the samples.
3. Be able to identify microscopic and macroscopic fungi samples

### **CONTENT**

In this course lab methods to study protozoan, technique to examine blood, tissue and fecal samples, sampling and preparation of samples, staining and microscopic testing will be covered.

1. Helminthology:

Diagnostic methods to experiment parasitic worm diseases, techniques to test feces and urine samples and morphological studies.

2. Entomology:

Biology and morphological identification of arthropods and the methods to prevent them

### **3. Mycology**

**Diagnosis of fungal diseases, sampling methods, direct testing, culture and microscopic and macroscopic identification of saprophyte and pathogenic fungi**

#### **SOURCES**

- 1. Medical Parasitology; Dr. Brown**
- 2. Medical Parasitology; Dr. Woog**

#### **ASSESSMENT METHOD**

- 1. Identification of microscopic larvae and parasite and worm samples 80%**
- 2. Multiple choice test 20%**

**COURSE NAME:** Immunology

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Microbiology, Parasitology and Mycology

### **GENERAL AIMS**

Familiarizing students with the science of immunology and its use in understanding, preventing, diagnosis and treatment of disease.

### **COURSE DESCRIPTION**

The functions of the immune system and body defense mechanisms, different body organs which have significant roles in the functions of the immune system and the different types of immunity in body will be covered.

### **LEARNING OUTCOMES**

Students must:

1. Know pathogens and immunologic mechanism of diseases
2. Know resistance against diseases
3. Know lab diagnosis methods
4. Know immunologic substances used to cure diseases

### **CONTENT**

1. Cells and lymphatic organs
2. Antigens
3. The structure of immunoglobulins
4. Antibody production and humoral immunity
5. Complement
6. Antigen and antibody reaction
7. Tissue antigens
8. Immunohematology
9. Principles of auto immunity



- 10. Immunosuppressors and tolerance**
- 11. Immuno-pharmacology**
- 12. Cancer immunity**
- 13. Vaccination reaction**
- 14. AIDS**

## **SOURCES**

**Immunology; Dr. Vejgani**

## **ASSESSMENT METHOD**

- 1. Multiple choice test 90%**
- 2. Oral presentation 10%**

**COURSE NAME:** Immunology

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITES:** Microbiology, Parasitology and Mycology

### **GENERAL AIMS**

Familiarizing students with different immunologic diagnosis methods, including blood group determination, immunoelectrophoresis, HLA determination ...

### **COURSE DESCRIPTION**

Familiarizing students with different lab equipment and diagnostic testing kits and their use

### **LEARNING OUTCOMES**

Students must:

1. Know the chemicals used for blood typing.
2. Know precipitation methods using electrophorus.
3. Know diagnostic methods like Wright test, VDRL test and blotting.

### **CONTENT**

1. Blood group, RH and combustion.
2. Precipitation in aqueous media and immunoelectrophoresis
3. Fagocytosis and rosette test
4. HLA
5. Antibody detection using immunofluorescence
6. Immune hemagglutination
7. Nitrous complement fixation
8. Toxoplasmosis using immunofluorescence
9. Pregnancy and CRP tests
10. VDRL and abs FTA
11. Intro to Blotting
12. Intro to LTT, LMT
13. ELISA method

## **14. Introduction to RIA**

### **SOURCES**

**Immunology; Dr. Veigani**

### **ASSESSMENT METHOD**

- 1. Lab diagnostic tests and team work 80%**
- 2. Multiple choice test 10%**

**COURSE NAME:** Health Care Principles

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Theoretical

**PREREQUISITES:** -

### **GENERAL AIMS**

**Familiarizing students with health care principles and health care system in the country**

### **COURSE DESCRIPTION**

**Because of the important role of the pharmacist in the health care cycle, it is important to increase knowledge of different health care systems and services, and this course provides students with sufficient information on the topic.**

### **LEARNING OUTCOMES**

**Students must:**

- 1. Know the basic principles of health care.**
- 2. Know the level of health care services.**
- 3. Know the health care system compartments and understand the role of the pharmacist in the system.**

### **CONTENT**

- 1. Definitions of health care, public health and hygiene.**
- 2. The scope of health care services**
- 3. Individual and social health**
- 4. Health indicators**
- 5. Components of basic health care.**
- 6. The role of the pharmacist in health care**
- 7. Use of epidemiology in health care**
- 8. Protection against contagious diseases**
- 9. Environmental health**
  - Water hygiene**

- **Food products hygiene**
- **Air pollution and effects on public health**
- **Soil pollution and effects on public health**

**10. Professional health**

**11. Family and school health**

**12. Dental health**

**13. Mental health**

## **SOURCES**

**Public Health; Dr. Mohammad Ali Molavei & Dr. Giti Samar**

## **ASSESSMENT METHOD**

- 1. Essay type and multiple choice test 80%**
- 2. Work report and team work 20%**

**COURSE NAME: Psychology**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Theoretical**

**PREREQUISITES: -**

### **GENERAL AIMS**

- Familiarizing students with the principles of psychology
- Familiarizing students with Islamic views of human mind and soul
- Familiarizing students with learning methods, thought process and perception

### **COURSE DESCRIPTION**

Knowing the basic principles of psychology, different sense and thought processes is central to building a more effective relationship between the pharmacist and the patient and therefore this course will increase the knowledge of the pharmacist.

### **LEARNING OUTCOMES**

Students must:

1. Know the relationship between psychology and human mind and soul.
2. Know the principles of psychology.
3. Be able to explain different sense stages.
4. Know learning methods and thought processes.
5. Know human motivation.
6. Know psychological health.
7. Know the physiological principles of psychology.

### **CONTENT**

1. Man from the Islamic viewpoint
2. The relationship between psychology and human mind and soul
3. The relationship between psychology and other sciences and its use in medicine
4. Physiological and psychological principles
5. Growth in Islam
6. Growth in psychology

- 7. Perception**
- 8. Senses**
- 9. Learning and thought**
- 10. Memory and forgetting**
- 11. Language and thought**
- 12. Physiological principles of stimulation**
- 13. Personality evaluation**
- 14. Human motivation and stimulation**

## **SOURCES**

- 1. Psychology of Learning; Dr. Seyf**
- 2. Principles of General Psychology; Dr. Azimi**

## **ASSESSMENT METHOD**

- 1. Multiple choice test 40%**
- 2. Essay type test 40%**
- 3. Team work results 20%**

**COURSE NAME:** Sociology and Anthropology

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** -

### **GENERAL AIMS**

The main objective of this course is to familiarize students with culture and its use in different communities, particularly those existing in Iran. Society, social structures and sociocultural phenomena, formation and processes of these phenomena are other topics covered in this course.

### **COURSE DESCRIPTION**

Because people from different ethnic groups and with different languages may seek the help of the pharmacist, a better understanding of these cultural varieties enables the pharmacist to help these patients more thoroughly and therefore this course discusses different communities, sociological theories and social patterns.

### **LEARNING OUTCOMES**

Students must:

1. Know common expressions in sociology and anthropology.
2. Know the theories of sociology and anthropology.
3. Know different areas of sociocultural studies.

### **CONTENT**

1. Concepts and expressions in sociology and anthropology
2. History of these two fields and their standing in social sciences\
3. Culture( structure, characteristics, its change processes and formation of different communities)
4. Cultural relativisms, genocide, assimilation
5. Sociological and anthropological theories



## **SOURCES**

- 1. Studying Human Societies; Gerhard Lenski.**
- 2. Sociology ; Anthony Giddens**
- 3. Cultural Anthropology; Daniel Beats**
- 4. Culture and Society; Rosamond Bilington**

## **ASSESSMENT METHOD**

**Multiple choice and essay type final exam 100%**

**COURSE NAME:** Clinical Biochemistry

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Fundamental Biochemistry

## **GENERAL AIMS**

**Familiarizing students with:**

- **Biochemical reactions in body and impairments.**
- **Kidney and liver functions and measurable factors to evaluate kidney and liver functions.**
- **Clinical biochemical experiments and their use in disease diagnosis**

## **COURSE DESCRIPTION**

**All measurable factors directly related to body functions and the role of individual organs in regulating body actions are the topics covered in this course.**

## **LEARNING OUTCOMES**

**Students must:**

- 1. Know all body biochemical reactions**
- 2. Know all related measurable factors in organ functions.**
- 3. Know the role of the kidney in fluid and electrolyte regulation and acid-bas balance.**
- 4. Know the role of the kidney in organic metabolism and the related impairments.**
- 5. Know the impairments of different glands and the functions of hormones in disease diagnosis.**

## **CONTENT**

- 1. An introduction to clinical biochemistry and its use in disease control**
- 2. Liquid and electrolyte related impairments**
- 3. Acid-bas balance and the related impairments**
- 4. Lipoproteins**
  - **Different lipoprotein structures**

- Lipoprotein biosynthesis
- Impairment resulting from plasma lipoproteins increase/decrease
- Apoproteins and their roles in diagnosis
- 5. Plasma proteins
  - Separation methods
  - Identification and measurement methods
  - The importance of plasma proteins in disease diagnosis
- 6. Clinical enzymology
  - Use of enzymes in disease diagnosis
  - Use of isoenzymes and their use in diagnosis
  - Measurement and separation of isoenzymes
- 7. Metabolic impairments and related diseases
  - Carbohydrates
  - Amino acids and proteins
  - Fats
- 8. Rare elements metabolism
  - The roles of elements in biochemical processes
  - The relation between change in element density and diseases
  - Biochemical tests of kidney and liver functions
- 9. Hemoglobin
  - Metabolism
  - Types
  - Role in disease diagnosis
  - Prophyryns
- 10. Hormonal clinical chemistry
  - Metabolism of thyroid hormones and their changes in different diseases
  - Metabolism of parathyroid hormones and their changes in different diseases
  - Metabolisms of pituitary hormones
  - Metabolism of steroid hormones
- 11. Pregnancy and metabolic diseases

## **SOURCES**

**Clinical Chemistry; Norbet Tietz, 2002.**

## **ASSESSMENT METHOD**

**Multiple choice midterm and final exam 100%**

**COURSE NAME: Medicinal Plants**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Theoretical**

**PREREQUISITES: -**

### **GENERAL AIMS**

- **Giving students perspective about the status of medicinal plants**
- **Familiarizing students with important medicinal plants of Iran and the world**
- **Familiarizing students with the effects of Pharmacology and the effect mechanisms of medicinal plants**
- **Enabling students to work in medicinal plant factories after graduation**
- **Familiarizing students with plant systematics, kingdom, order, family, genus and species**
- **Teaching methods to collect, dry and store medicinal plants**

### **COURSE DESCRIPTION**

**Familiarizing students with plant systematics and the therapeutic effects of plants and classifications based on the type of effect**

### **LEARNING OUTCOMES**

**Students must:**

- **Know the role of medicinal plants in medical sciences**
- **Know the important effects of medicinal plants**

### **CONTENT**

- **Fundamentals**
- **The value of medicinal plants**
- **Medicinal plants used in gastrointestinal diseases**
- **Medicinal plants affecting central nerves**
- **Medicinal plants affecting the heart and blood vessels**
- **Medicinal plants affecting the skin**

- Medicinal plants affecting the kidney and the liver
- Use of medicinal plants in cosmetics
- The rest of important medicinal plants and introduction of medicinal plants existing in Iran

## **SOURCES**

1. Zargari. A; Medicinal Plants, Tehran University Publications
2. Evans, W. C; Trease and Evan's Pharmacognos, W.B Saunders Co, London 1996

## **ASSESSMENT METHOD**

1. Multiple choice test 40%
2. Essay type test 50%
3. Article 10%

**COURSE NAME: Medicinal Plants**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: -**

### **GENERAL AIMS**

- **Enabling students perform microscopic and macroscopic identification of powdered medicinal herbs**
- **Using microscopic and macroscopic methods to identify plant systematics**
- **Methods to collect and prepare herbarium**
- **Familiarization with medicinal plant resources in Iran**
- **Visiting medicinal plants museum and making plant collections**

### **COURSE DESCRIPTION**

**Microscopic and macroscopic identification of medicinal plants**

### **LEARNING OUTCOMES**

**Students must:**

- 1. Perform macroscopic identification of medicinal plant forms**
- 2. Be able to use keys for systematic identification of plants**

### **CONTENT**

**Methods to prepare microscopic samples of medicinal plants and examining their macroscopic characteristics**

- **Mint species**
- **Sunflower species**
- **Borage species**
- **Olive species**
- **Snapdragon species**
- **Fleawort species**
- **Salep species**
- **Cotton species**

- **Rose species**
- **Other important plant species**

## **SOURCES**

1. **Plant Systematics; Mozaffarian**
2. **Medicinal Plants Identification and Analysis; Samsam Shariat**

## **ASSESSMENT METHOD**

1. **Identification of plant powder**
2. **Microchemical testing methods**
3. **Herbarium preparation**
4. **Essay type test**

**COURSE NAME:** Pharmacognosy 1

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Medicinal Plants

### **GENERAL AIMS**

Familiarizing students with:

- Organic compounds of the carbohydrates group
- Organic compounds of the glycoside group
- Organic compounds of lignin and lignin group
- Organic compounds of the tannin group
- Organic drug resources
- Therapeutic effects and organic compound use

### **COURSE DESCRIPTION**

In this course the structure of chemicals, the classifications of compounds existing in plants and their biological effects will be discussed.

### **LEARNING OUTCOMES**

Students must:

1. Be able to explain primary and secondary metabolites.
2. Be able to explain the molecular structure and use of: carbohydrates, glycosides, lignins, lignans and tannins

### **CONTENT**

- Principles
- History
- Value and importance of medicinal plants use
- Future of medicinal plants use
- Novel drugs with plant source



- Carbohydrates
- Principles, therapeutic effects, use and carbohydrate chemical structure, including
  - a. Starch
  - b. Cellulose
  - c. tragacanth
  - d. gum
  - e. Mucilage
  - f. Agar
  - g. Alginate
  - h. Pectin
  - i. Xanthan
  - j. Dextran
  - k. Medicinal plant sources of carbohydrates
  - l. Glycosides
  - m. Principles, therapeutic effects, use glycoside chemical structure, including:
    - Saponin
    - Antraquinone
    - Cardiac glycosides
    - Cyanogenic glycosides
    - Glucosinolates
    - Aldehyde glycosides
    - Lignins and lignans
    - n. Tannins
- Principles, therapeutic effects, use and chemical structure of tannins

## **SOURCES**

1. Robbers, J.E, Speedie, M.K and Tyler V.E: Pharmacognosy and Pharmacobiotechnology. Williams and Wilkins, Baltimore(1996)
2. Evans W.C: Trease and Evan's Pharmacognosy. W.B Saunders Co, London (1996)

## **ASSESSMENT METHOD**

1. Multiple choice test 40%
2. Essay type test 50%
3. Article translation 10%

**COURSE NAME:** Pharmacognosy 2

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmacognosy1

### **GENERAL AIMS**

Familiarizing students with:

- Organic compounds from lipid group
- Organic compounds from essence group
- Organic compounds from resin group
- Organic compounds of terpenoids and steroids
- Therapeutic effects and use of these organic compounds

### **COURSE DESCRIPTION**

In this course the structure of chemicals, the classifications of compounds existing in plants and their biological effects will be discussed.

### **LEARNING OUTCOMES**

Students must:

1. Know the principles of primary and secondary metabolites.
2. Know the molecular structure, use and pharmacological effects of:
  - Essences
  - Resins
  - Terpenoids
  - Steroids

### **CONTENT**

1. Lipids
  - Principles, therapeutic effects and chemical structure of lipids, including:

- a. Saturated and unsaturated fatty acids
  - b. Vaccines
  - c. Prostaglandins
  - d. Lipid containing medicinal plants
  - e. Protein containing medicinal plants
2. Essences
- Principles, therapeutic effects and chemical structure of essences, including:
    - a. Phenyl propanes
    - b. Carbohydrates
    - c. Alcohols
    - d. Ethers
    - e. Oxides
    - f. Aldehydes
    - g. Ketons
    - h. Esters
    - i. Essence containing medicinal plants
3. Resins
- Principles, therapeutic effects and chemical structure of resins, including:
    - a. oleoresins
    - b. Gum resins
    - c. Balsams
    - d. Oleo gum resins
    - e. Some resin containing medicinal plants
4. Terpenoids
- Principles, therapeutic effects, use and chemical structure of terpenids, including:
    - a. Hemiterpenoids
    - b. Monoterpenoids
    - c. Sesquiterpenoids
    - d. Diterpenoids
    - e. Triterpenoids
    - f. Gibberellin
    - g. Carotenoids
5. Steroids
- Principles, therapeutic effects, use and chemical structure of steroids

## RESOURCES

- 6. Williams and Wilkins, Baltimore(1996)
- 7. Evans W.C: Trease and Evan's Pharmacognosy. W.B Saunders Co, London (1996)

## **ASSESSMENT METHOD**

- 8. Multiple choice test 40%**
- 9. Essay type test 50%**
- 10. Article translation 10%**

**COURSE NAME: Pharmacognosy2**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Practical**

**PREREQUISITES: Pharmacognosy1**

### **GENERAL AIMS**

- Gaining proficiency in extraction, separation, identification and quantification of organic compounds.
- Preparation for research proposals in the field of medicinal plants.
- Gaining proficiency to work in medicinal plants companies.

### **COURSE DESCRIPTION**

In this course methods to extract, separate and identify compounds in plants will be taught.

### **LEARNING OUTCOMES**

Students must have enough proficiency to extract, separate, identify and quantify organic compounds.

### **CONTENT**

Separation, extraction and quantification of

- Carbohydrates
- Glycosides
- Flavonoids
- Antrakinons
- Carotenoids
- Alkaloids
  - a. opium alkaloids
  - b. Tropane alkaloids
  - c. Purine alkaloids
- Essences
- Resins

- Tannins
- Lipids

## **SOURCES**

1. Harborne, J.B; **Phytochemical Methods**. Chapman & Hall, London (1989)
2. Robinson, T; **The Organic Constituents of Higher Plants**, Cordus Press, New Ahmerst (1983)

**COURSE NAME:** Ethics in Pharmacy

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Theoretical

**PREREQUISITES:** -

### **GENERAL AIMS**

Because of the importance of the relations between the patients and the pharmacist and the significance of services provided by the pharmacist, students are familiarized with ethics in pharmaceutical sciences in particular, and Islamic values in general.

### **COURSE DESCRIPTION**

Because of the direct contact between patients and pharmacist, proper interaction with patients and maintaining ethical values are taught in this course.

### **LEARNING OUTCOMES**

Students must:

- Have a high command of ethical principles and values.
- Have the proper decision making abilities in case of ethical dilemmas

### **CONTENT**

- Definition of ethics and ethical principles
- Ethical philosophy and ethical theories
- Role and standing of ethics in pharmacy
- Principles of ethics in Iran and Islam
- Pharmaceutical ethics in west
- Doctor- patient relationship
- Ethical dilemmas
- Ethical principles in pharmacy

### **SOURCES**

Remington's Pharmaceutical sciences, Ethics

## **ASSESSMENT METHOD**

- 1. Research in the existing ethical literature 30%**
- 2. Essay type and multiple choice test 70%**



**COURSE NAME:** Medicinal Chemistry 1

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Organic Chemistry and Pharmacology

### **GENERAL AIMS**

- 1) Students' familiarity with the fundamentals of medicinal chemistry and drug design
- 2) Students' familiarity with the relationship between the chemical structure of the drug and receptor and the relationship between the structure and effects, side effects and drugs' Pharmacokinetics.
- 3) Application of the learned material in the formulation of drugs and synthesis of raw materials.

### **COURSE DESCRIPTION**

Fundamentals of drug design and chemical structure of different groups of drugs and therefore different methods of Synthesis of raw materials are discussed.

### **LEARNING OUTCOMES**

- 1) Students should be able to interpret the basic concepts of medicinal chemistry and drug design.
- 2) Using chemical structure of the drugs, students should be able to comment on the effects, side effects and drug Kinetics.
- 3) They should know the concept of optimal medication use.
- 4) They should interpret the methods of synthesis of raw materials.
- 5) Students must know the structure of different antibiotics in each category.

### **CONTENT**

- 1) Arrangements including the impact of physical and chemical properties on absorption and distribution of drugs.
- 2) Structure of receptor and the forces involved in drugs' interactions with receptor.
- 3) The effect of the chemical, stereochemical and Bioisosteric structures on drug action.
- 4) Quantitative relationship between structure of drugs and biological activity and the use of computers.

- 5) Sulfonamides
- 6) Antiseptics
- 7) Penicillin
- 8) Non-classical beta-lactam(Betaactamase and Monobactams inhibitors )
- 9) Sefalosporins
- 10) Quinolones
- 11) Tetracyclines
- 12) Amino glycosides
- 13) Polypeptides antibiotics and Macrolides, Other antibiotics.
- 14) Radiopaques
- 15) Anti-fungal, anti-parasite, anti-amoeba drugs.
- 16) Anti-Virus drugs
- 17) Anticancer drugs

#### **SOURCES:**

1. William O. Foye, Thomas L. Lemke, David A Williams

Principles of Medicinal Chemistry,Williams and Wilkins; U.S.A 1995.

2. James N. Delgado, Williams A. Remer, Wilson and Gisvold's text book of Organic Medicinal and Pharmaceutical Chemistry, J.B Lippincott Company
3. Andrejus Korokovas, Essentials of Medicinal Chemistry, John Wiley and Sons U.S.A 1988

#### **ASSESSMENT METHOD:**

1. Essay type exam: 50 %
2. Multiple choice exam: 35%
3. Oral presentation:15%

**COURSE NAME:** Medicinal Chemistry 3

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Medicinal Chemistry 1

#### **GENERAL AIMS**

- 1) Students' familiarity with release of amine drugs, antidepressants and monoamine oxidase inhibitor.
- 2) Students' familiarity with Hypnotic, anti-psychosis, anti-epileptic and anti-Parkinson drugs, and verification of the effect of these compounds in their mode of action.

#### **COURSE DESCRIPTION**

Fundamentals of drug design and chemical structure of different groups of drugs and therefore different methods of Synthesis of raw materials are discussed.

#### **LEARNING OUTCOMES**

- 1) Students should know the structure of release of amine drugs and MAO Inhibitors.
- 2) Students should know the structure and mode of action of compounds which effect CNS.

#### **CONTENT**

- 1) Bicyclic antidepressants
- 2) Monocyclic antidepressants
- 3) MAO Inhibitors
- 4) Drugs used to treat psychosis
- 5) Dopamine agonists
- 6) Anti-Parkinson drugs
- 7) Hypnotic drugs
- 8) Anti-anxiety drugs and muscle relaxants
- 9) Antiepileptic Drugs
- 10) Tricyclic Antidepressants

- 11) Gamma agonists and antagonists
- 12) Benzodiazepines
- 13) Non-benzodiazepine anti-anxiety drugs
- 14) Pain medications with a central effect
- 15) Narcotic Pain medications
- 16) Narcotic antagonists
- 17) Hallucinogens
- 18) Drugs that affect mucus
- 19) Pain medications and nonsteroidal anti-inflammatory

## **SOURCES**

4. William O. Foye, Thomas L. Lemke, David A Williams  
Principles of Medicinal Chemistry, Williams and Wilkins; U.S.A 1995.
5. James N. Delgado, Williams A. Remer, Wilson and Gisvold's text book of Organic Medicinal and Pharmaceutical Chemistry, J.B Lippincott Company
6. Andrejus Korokovas, Essentials of Medicinal Chemistry, John Wiley and Sons U.S.A 1988

## **ASSESSMENT METHOD**

1. Essay type exam: 50 %
2. Multiple choice exam: 35%
3. Oral presentation: 15%
4. Lab report: \_

**COURSE NAME:** Pharmacology

**NUMBER OF CREDITS:** 4

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Physiology 2, Fundamental Biochemistry

**GENERAL AIMS:**

students' familiarity with autonomic nervous system drugs, Pharmacodynamics, Drugs on neuromuscular transmission , Pain medications , Antibiotics , digestive system drugs and Skin Medications and -The mechanism of these drugs.

**COURSE DESCRIPTION:**

Considering that one of the most vital and important part of pharmacy education is familiarity with medications and how they work, Therefore, in this study the mechanism of action of drugs, Different groups of drugs, The absorption and excretion of drugs, Medications interactions with other compounds in the body, Kinetics of drugs and their proper usage are discussed.

**LEARNING OUTCOMES**

Students should be able:

- To interpret generalities about receptors and secondary messenger pharmacodynamics.
- To explain the various stages of clinical assessment of drugs.
- To describe different drug groups and interpret their mechanisms.
- To explain the different types of chemical carriers and related drugs.
- To list the uses of medications.
- To classify the medications and their uses.
- To explain the variety of side effects of drugs and how to avoid complications.
- To explain the principles of drug-drug interactions and food- drug interactions.
- To illustrate the proper use of drugs in specific groups (Pregnancy, breastfeeding, children and the elderly, and certain diseases)
- To explain generalities about pharmacogenetics.
- To present the correct ways of taking medications.
- To explain the effects of various diseases on the pharmacodynamics and pharmacokinetics.

- To interpret the general principles of prescribing.
- To explain the drug abuse and measures to reduce or prevent it.
- To be familiar with the latest advances in the field of new medications and their advantages compared to previous medications.

## CONTENT

### 1) Generalities of Pharmacology (Definitions)

Pharmacodynamics, Medical receptors and the mechanism of drug-receptor interactions.

Pharmacokinetics: Absorption Distribution Metabolism and excretion.

Basic and clinical assessment of drugs.

### 2) medications affecting the autonomic system

- Introduction to Pharmacology autonomic system
- Cholinergic medications
- Anticholinergics
- Adrenergic medications
- Anti-adrenergic medications

### 3) Medications affecting neuromuscular transmission.

- Histamine and medications affecting it
- Serotonin and medications affecting it
- Platelet-activating factor and medications affecting it
- Quinine and medications affecting it
- Eicosanoids: Prostaglandins, Thromboxane, Leukotrienes.

### 4) Nonsteroidal anti-inflammatory Medications, Non-narcotic pain medications and anti-gout.

### 5) local anesthetic

### 6) Narcotic pain medications and their antagonists.

### 7) Drug abuse

### 8) Chemotherapeutic agents

#### a- Antibiotics

- History and principles of application of chemotherapy agents.
- Sulfonamides, Sulfones, trimethoprim.
- Beta-lactams: penicillin, cephalosporins, betalactamase inhibitors)
- Floro quinolones, Nitrofurans, metnamin
- Aminoglycosides, Polymyxin.
- Tetracyclines, Chloramphenicol, Macrolides.
- Anti-tuberculosis and Leprosy

#### b- Disinfectants

#### c- Antifungal drugs

- d- Anti-virus drugs
- e- protozoa and other protozoa
- 9) Skin Medications
- 10) Gastrointestinal Drugs
- 11) The using medications in specific groups
  - Pregnancy, breastfeeding, children and the elderly, and certain diseases.
- 14) Selection of OTC Medications.
- 15) Drug poisoning and Coping Strategies

## **SOURCES**

1. Basic and Clinical Pharmacology ; Bertram G.K Wtzung
2. Pharmacology; H.P Rang/ M.M. DALE

## **ASSESSMENT METHOD**

1. Essay type exam: 60 %
2. Multiple choice exam: 30%
3. Oral presentation:10%

**COURSE NAME:** Pharmacology 2

**NUMBER OF CREDITS:** 4

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmacology 1

### **GENERAL AIMS**

The help students learn to study the mechanism of action of drugs and their adverse effects, Food-drug interactions, interpreting the amount of consumption in times of need.

### **COURSE DEFINITION**

Considering that one of the most vital and important part of pharmacy education is familiarity with medications and how they work, Therefore, in this study the mechanism of action of drugs, Different groups of drugs, The absorption and excretion of drugs, Medications interactions with other compounds in the body, Kinetics of drugs and their proper usage are discussed.

### **LEARNING OUTCOMES**

Students should be able:

- To interpret generalities about receptors secondary messengers
- To explain the various stages of clinical assessment of drugs.
- To explain the different categories of clinical assessment of drugs.
- To explain the role of various chemical carriers, and related Medications.
- To classify the medications and their uses.
- To explain the variety of side effects of drugs and How to avoid complications
- To explain the principles of drug-drug interactions and food- drug interactions.
- To illustrate the proper use of drugs in specific groups (Pregnancy, breastfeeding, children and the elderly, and certain diseases)
- To explain generalities about pharmacogenetics.
- To present the correct ways of taking medications.
- To explain the effects of various diseases on the pharmacodynamics and pharmacokinetics.
- To interpret the general principles of prescribing.
- To explain the drug abuse and measures to reduce or prevent it.



- To be familiar with the latest advances in the field of new medications and their advantages compared to previous medications.
- To interpret the principles of Medical advice and be able to use them In dealing with patients.

## CONTENT

- 1) Medications affecting the cardiovascular system
  - Factors affecting the renin-angiotensin system.
  - Antihypertensive medications
  - Diuretic drugs
  - Anti-angina Medications.
  - Drugs used in cardiac congestion
  - Drugs used in Cardiac Arrhythmias.
  - Drugs used in hyperlipidaemia
- 2) Respiratory drugs(Anti-asthma , cough medicine and ..)
- 3) Medications affecting the central nervous system.
  - Introduction to Central Nervous System Pharmacology.
  - Sedatives and hypnotics
  - Alcohols
  - Antiepileptic Drugs
  - General anesthetics
  - Drugs used in parkinsonism and other movement disorders
  - Antidepressants
  - Lithium and mania
  - Anti-psychotic drugs
- 4) Drugs used for blood disorders
  - Medications used for anemia
  - Drugs used in coagulation disorders.
- 5) Medications affecting the endocrine system:
  - The hypothalamus-pituitary hormones
  - Drugs used in hypothyroidism and hyperthyroidism
  - Pancreatic hormones and Medications Used for diabetes
- 6) Drugs used for cancer
- 7) Principles of Gene Therapy
- 8) Immunopharmacology
- 9) Drugs used for skeletal disorders
- 10) Drugs Interactions
- 11) Drug allergies and idiosyncrasy

## **SOURCES**

- 4. Basic and Clinical Pharmacology ; Bertram G.K Wtzung**
- 5. Pharmacology; H.P Rang/ M.M. DALE**

## **ASSESSMENT METHOD**

- 1. Essay type exam: 60 %**
- 2. Multiple choice exam: 30%**
- 3. Oral presentation:10%**

**COURSE NAME:** Pharmacology 2

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITES:** Pharmacology 1

### **GENERAL AIMS**

**A better understanding of the concepts of the pharmacology after laboratory observations.**

### **COURSE DESCRIPTION**

**How to use the research tools used in pharmacology and the study of how drugs work using animal models are taught in two methods.**

### **LEARNING OUTCOMES**

**After completing the course the students can design the pharmacological assessment of drugs.**

### **CONTENT**

**Introduction to lab equipment, devices, safety rules and preparation of the laboratory.**

**Learning how to work on lab animals and all kinds of injections.**

- **Preparation and mounting of smooth muscle in Beth organ and dose curve drawing-response to an agonist.**
- **Dose curve-response to an agonist in the presence of antagonist and dose curve drawing -response in response to an unknown drug.**
- **Data Processing with computer, drawing of the dose-response curves, detection of antagonists, Computing  $PA_2$  of unknown drugs.**
- **The effect of antagonists and agonists of the sympathetic and parasympathetic systems on rabbit eyes.**
- **Finkelman test (Impact of the size and contents of the intestines on Peristaltic bowel movements and the role of sympathetic and parasympathetic systems.)**
- **Assessment of the safety of drugs using cellular models.**
- **Cellular and molecular tests to predict Idiosyncrasy.**

- **Evaluation the effects of pain medications and anti-inflammatory using Hot plate and Tail Flick.  
Behavioral models in pharmacology.**

#### **SOURCE**

- 1. Text Book of Pharmacology; Rand and bowman, Last Edition**
- 2. Isolated Pharmacological Experiments; Last Edition**
- 3. Intact Pharmacological Experiments; Last Edition**

#### **ASSESSMENT METHOD**

- 1. Reports of practical work: 40%**
- 2. design of a medication experiment: 20%**
- 3. The practical exam: 40%**

**COURSE NAME: Toxicology**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Theoretical**

**PREREQUISITES: Pharmacology 2**

### **GENERAL AIMS**

**Contributing to learn the mechanism of toxicity and to classify different types of toxic toxins.**

### **COURSE DESCRIPTION**

**Since the drug acts as a poison if consumed over a certain amount, it is necessary to learn all kinds of toxins, including pharmaceutical and non-pharmaceutical, as well as the effect of these compounds on different body systems and how to deal with poisoning. These issues will be discussed in detail in this course.**

### **LEARNING OUTCOMES**

**After completing the course students will: Identify the mechanism of action of toxins after the classification.**

### **CONTENT**

**1) Generalities of Toxicology (History - Definition - Classification - toxic exposure)**

**2) Toxicokinetics**

**Absorption of toxic substances in biological systems, Cell membrane, Transportation of toxic substances out of the cell membrane, The absorption of toxic substances), Distribution of toxic conditions in the body, Levels of plasma, Half-life, AUC, Half-life, protein binding, Accumulation of toxins in the body, Excretion of toxins from the body and the influential factors (Urinary excretion , biliary excretion)**

**3) Metabolism of toxic compounds, Purpose of the metabolism in the body, Metabolism the consequences of, Phase 1 reactions (puse Cytochrome).**

**Phase1 reactions (oxidation – reduction, hydrolysis), Phase 2 reactions (Conjugation)**

**Reactions causing toxic and detoxification reactions, Factors affecting toxic responses.**

#### **4) Types of exposure and toxic responses**

(acute and chronic exposure, Ways of exposure, Types of toxic responses including Direct toxic effect, Biochemical damage, Physiological and pharmacologic effects, immunotoxicity, carcinogenicity, Biological markers.

Selective effects of toxins on organ including:

#### **5) Respiratory toxins**

- 1) Mitochondrial toxicity**
- 2) The toxicity of red blood cells**

#### **6) CNS toxins**

- 1) Excitotoxicity Seizure**
- 2) Alcohol and hallucinogens**

#### **7) Toxicity of drugs**

(Types of drug toxicity 1- side effects 2- Idiosyncrasy, Acetaminophen, Aspirin, Hydralazine, Halothane, Thalidomide, G-6-P-D shortage.

#### **8) Natural toxins**

#### **9) Animal toxins**

#### **10) Fungal and plant toxins**

### **SOURCES**

- 1. Toxicology; Casarett and Doull**
- 2. Poisoning and Drug Overdose; Haddad Winchester**
- 3. Natural Toxin; John Harris**

### **ASSESSMENT METHOD**

- 1. Multiple choice exam: 60%**
- 2. Case study: 40%**

**COURSE NAME:** Toxicology

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Practical

**PREREQUISITES:** Pharmacology 2

### **GENERAL AIMS**

Helping to learn how to treat poisoning, emergency operations, treatment of poisoning, Emergency operations and treatment of poisoning, experimental detection of toxins and methods of extraction from different tissues.

### **COURSE DESCRIPTION**

Different methods to detect chemical toxins and drugs on animals, as well as determining cytotoxicity of various compounds as toxic agents are introduced in this section and will be taught.

### **LEARNING OUTCOMES**

After completing the course the student should be able to extract various toxins from the tissues and various means and then identify them. Need to know how do to deal with the toxic emergency procedures.

### **CONTENT**

- 1) Generalities and principles of extraction: Of biological fluids and tissues, Non-biological environments
- 2) Extraction and identification of alkaline toxins
- 3) Extraction and identification of acidic toxins
- 4) Methods to identification and estimating the amount of metal toxins
- 5) Methods for Extraction and quantification and identification of organophosphate pesticide
- 6) Methods to quantify and identify the volatile toxins.(1)
- 7) Methods to quantify and identify the volatile toxins.(2)
- 8) The methods of extraction and determination of opioid
- 9) Toxicity tests with animals
- 10) Toxicity testing in animals and study the effect of antidotes

- 11) Tests of carcinogenic compounds identification
- 12) Cell assays (cell culture)
- 13) Extraction and isolation of Primary cells

#### **SOURCES**

1. Isolation and Identification of Drugs, Clarke
2. Medical Toxicology, Elenthorn
3. Poisoning and Drug Overdose, Haddad Winchester
4. Natural Toxin, John Harris
5. Toxicology, Cassarette and Doll
6. Remington
7. Current content

#### **ASSESSMENT METHOD**

1. Essay type exam: 20 %
2. Multiple choice exam: 10%
3. Evaluating the ability to perform practical work: (50%)



**COURSE NAME:** Poison Control

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Toxicology - Pharmacology and First Aid

### **GENERAL AIMS**

Helping students in terms of how to deal with poisoned people, providing emergency assistance, Familiarity with of poisoning antidotes

### **COURSE DESCRIPTION**

Necessary knowledge on how to deal with people who have taken too many drugs. So their familiarity with toxicity of chemical compounds and drugs, as well as how to deal with the subjects is the main objective of this course.

### **LEARNING OUTCOMES**

1. Students should know the common pharmaceutical and non-pharmaceutical poisonings.
2. Students must interpret the methods of controlling common poisonings and detoxification of body.
3. Students must know how to deal with poisoned patients.
4. Students must know the antidotes.

### **CONTENT**

- 1) Emergency treatment of poisoning
- 2) Toxicity of oil and acid and alkaline and detergents
- 3) Poisoning caused by bleaches and antiseptics and pesticides
- 4) Toxicity of chemical and biological weapons
- 5) Poisoning caused by cardiovascular drugs
- 6) Poisoning caused by neuroleptic and antidepressants.
- 7) Poisoning caused by tranquilizers and sleep aids
- 8) Poisoning caused by nonsteroidal anti-inflammatory drugs – acetaminophen
- 9) Poisoning caused by gases and solvents

**10) Toxicity of metals**

**11) Food toxicity, food Additives and Supplements.**

## **SOURCES**

- 1. Medical Toxicology, Elenthorn**
- 2. Poisoning and Drug Overdose, Haddad Winchester**
- 3. Natural Toxin, John Harris**
- 4. Toxicology, Cassarette and Doll**

## **ASSESSMENT METHOD**

- 1. Multiple-choice questions and essay: 80%**
- 2. Providing a model of toxicity and its treatment theoretically: 20%**

**COURSE NAME:** Physical Pharmacy 1

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Mathematics and simultaneously with Pharmaceutics

### **GENERAL AIMS**

- Students' familiarity with physicochemical principles and concepts in formulation of pharmaceutical preparations.
- Students' familiarity with bands and isotonic solutions
- The physicochemical principles and concepts in manufacturing drugs and also physical laws interfering in the preparation of drugs and their formulations are discussed in this course.

### **COURSE DESCRIPTION**

The use of physicochemical fundamentals in drug preparation and the physical laws affecting drug formulations are discussed in this course.

### **LEARNING OUTCOMES**

Students must:

- Interpret principles of the isotonic solution and buffer preparation.
- Name the Factors affecting the solubility of drugs and methods of increasing the speed of dissolution.
- Explain the concepts of thermodynamics.
- Explain different states of materials (solid, liquid, gas and liquid crystal).
- Explain the effect of temperature, Polymorphism etc. on Drugs' Formulation and Stability.
- List different methods to prepare Isotonic and buffered solutions.
- Interpret the importance of dissolution in drug formulation.
- Explain the properties of non-electronic solutions and its application in pharmaceutics.
- Interpret the difference between real and ideal solutions.
- Explain Calculation of the pH
- Explain the concept of complex of and its types.

## CONTENT

- 1) The status of Physical pharmacy in pharmaceuticals
- 2) Application of equilibrium phases in pharmaceuticals.
- 3) Phase curve drawing (two-variable and three-variable )
- 4) phases equilibrium and liquid crystal
- 5) Actual and ideal solutions
- 6) Application of laws of the vapor pressure (in aerosols), Decreasing freezing point, osmotic pressure and increasing boiling point.
- 7) Activity coefficient of the acid and base and solvent, ionic strength
- 8) Calculation of the pH, strong acids and bases, conjugate pairs and acid and base, Independent pairs of acid and base and its application in the preparation of pharmaceutical products
- 9) Buffers in pharmaceuticals
- 10) Isotonic solution
- 11) Application and importance of the complex formation and the bonding of drugs to protein.

## SOURCES

1. Physical Pharmacy; Mantin
2. Pharmaceutical Sciences; Remington
3. Physicochemical Principles of Pharmacy; Attwood
4. Pharmaceutis; Aulton

## ASSESSMENT METHOD

Mid-term exam (Essay and multiple choice) : 30%

Final exam (Essay and multiple choice) : 40%

Problem solving: 30%

**COURSE NAME:** Physical Pharmacy 2

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Physical Pharmacy 1

### **GENERAL AIMS**

- 1) Students' familiarity with the laws of diffusion, micrometrics
- 2) Students' familiarity with the definition of particle size and techniques of particle size measurement.
- 3) Students' familiarity with the speed and degree of reactions, definitions of surface tension
- 4) Students' familiarity with the laws of rheology
- 5) Students' familiarity with distributed systems and polymers

### **COURSE DESCRIPTION**

- In this course physicochemical principles and concepts in manufacturing of drugs and also the physical laws affecting the preparation and formulation of medicines are discussed.

### **LEARNING OUTCOMES**

- 1) Students interpret the diffusion phenomenon and its dissemination and importance in the Pharmacy.
- 2) Students interpret the various methods of measuring the particle diameter.
- 3) Students interpret the size distribution of particles.
- 4) Students name the effective factors in the sustainability and construction of distributed systems.
- 5) Students name factors affecting stability and instability of the drug.
- 6) Students interpret principles and proper storage conditions for medicines.
- 7) Students interpret the drug resistance assessment methods.
- 8) Students explain methods of determining medicine shelf life and improving it.
- 9) Students define the surface tension phenomenon and explain the method of measurement.
- 10) Students explain surfactants and their use in Pharmacy.

- 11) Students explain Newtonian and non-Newtonian systems and application of rheology in Pharmacy.
- 12) Students interpret the factors involved in the rheology of liquids and semi-solids.
- 13) Students name classifications physicochemical properties of polymers.

## CONTENT

- 1) Diffusion and dissolution (Introduction of the topic, explaining and discussing the passive Diffusion and interpretation of spontaneous movement, Fick laws, the dissolution rate)
- 2) Micrometrics (Definitions, size and variety of diameters, geometrical average diameter, Various techniques for measuring particle diameter Including sieve, microscopes, Sedimentation rate, and particle shape and surface measurement methods.
- 3) Clinic and sustainability (The speed and degree of the reactions, factors affecting the stability of pharmaceutical products, how to determine the sustainability and expiration date)
- 4) Interfacial phenomena (Definitions: Surface tension, surfactants, and surface tension measurements.
- 5) Rheology (Definition and classification of rheological behavior, method for measuring Viscosity)
- 6) Dispersed systems (Potential of autoflocculation, protective colloids and micro-emulsification and emulsification theory, chemical and physical sustainability of suspensions and emulsions.
- 7) Colloids: Definition and Classification of colloids(Viscosity, electrical properties, etc)
- 8) Polymers: (Definitions, types of polymers, mechanisms of polymerization, water soluble and insoluble polymers and their applications.

## SOURCES

5. Physical Pharmacy; Mantin
6. Pharmaceutical Sciences; Remington
7. Physicochemical Principles of Pharmacy; Attwood
8. Pharmaceutis; Aulton

## **ASSESSMENT METHOD**

- 1. Midterm exam (essay type, multiple-choice) 30%**
- 2. Final exam (essay type, multiple-choice) 60%**
- 3. Problem solving 10%**

**COURSE NAME: Pharmaceutics 1**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Theoretical**

**PREREQUISITE: -**

### **GENERAL AIMS**

**Students' familiarity with the Old Pharmacy and the evolution of pharmacy, Method of prescribing, the recognition of different pharmaceutical forms, Pharmaceutical Resources and Pharmaceutical Calculations**

### **COURSE DEFINITION**

**History and evolution of the field of pharmacy and pharmaceutical Laws; quantitative methods in Drug development, and familiarity with the structure of the country's pharmaceutical system are discussed in this section.**

### **LEARNING OUTCOMES**

- **Students need to understand the field of Pharmaceutics (Manufacture, development, control and evaluation of products)**
- **interpret different naming systems**
- **Explain the different ways of prescribing.( Oral, intravenous)**
- **Explain Calculations needed to determine dosage and Manufacture.**
- **Name different primary, secondary and tertiary sources and to interpret how to use existing databases.**
- **Explain the country's pharmaceutical system.**

### **CONTENT**

- **Introduction to the field of Pharmaceutics**
- **Definition and naming of drugs**
- **Methods of drug prescribing.**
- **Basic familiarity with the types of drugs**
- **Pharmaceutical Calculations**
- **References in Pharmaceutics**



- Familiarity with pharmaceutical system in the country
- Definition of prescription and Abbreviations.

## **SOURCES**

1. Remington's Pharmaceutical Sciences
2. Encyclopedia of Pharmaceutical Technology ( some chapters)
3. Drug Information, a Guide to Current Resources; Bonnie Snow; 1989
4. Introduction to Pharmaceutical Dosage Forms and Drug Delivery Systems, Anset, 1995.

## **ASSESSMENT METHOD**

1. Final exam ( essay and multiple choice) : 75%
2. Research project on a drug formation ( based on Pharmacopeia, the reference book

**COURSE NAME:** Pharmaceutics2 (solids)

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmaceutics 1

### **GENERAL AIMS**

1. Students' familiarity with the pharmaceutical operations and formulations.
2. Students' familiarity with Pharmaceutical systems in the form of powders, tablets and capsules

### **COURSE DESCRIPTION**

Types of pharmaceutical operations in the first stage or in other words, the pre-formulation as well as recognition of the solid dosage forms and factors involved in the design of solid drugs are discussed

### **LEARNING OUTCOMES**

- Students should know the different operations in Pharmacy
- Students need to know the types of pre-formulation
- Students should recognize a variety of dosage forms such as tablets, capsules, powders.

### **CONTENT**

- 1- Pharmaceutical Operations
  - 1-1 Mixing
  - 1-2 Mitting
    - 1-2-1 particle size decrease
    - 1-2-2 Particle size distribution
    - 1-2-3 measuring the diameter of the particles
  - 1-3 Drying
- 2- Pre-formulation
  - 2-1 Methods of drug intake

## **2-2 Effective Factors in dosage form design**

### **2-2-1 Organoleptic properties**

### **2-2-2 Particle sizes and particle surfaces**

### **2-2-3 Solubility and dissolution**

### **2-2-4 The distribution coefficient and acidity**

### **2-2-5 Crystal**

### **2-2-6 Sustainability**

## **3- Powder**

### **3-1 Advantages and disadvantages of powders and granules**

### **3-2 Types**

### **3-3 Manufacturing technology**

### **3-4 Packing**

## **4- Packing**

### **4-1 Generalities**

#### **4-1-1 history and definition**

#### **4-1-2 Advantages and disadvantages**

#### **4-1-3 Types of tablets (plain, chewable and sublingual)**

#### **4-1-4 Tablet Features**

### **4-2 Formulation components**

#### **4-2-1 Non-drug components**

#### **4-2-2 Factors affecting the formulation**

### **4-3 Methods of manufacturing**

#### **4-3-1 Generalities**

##### **4-3-1-1 Direct compression**

##### **4-3-1-2 Dry granulation**

##### **4-3-1-3 Wet granulation**

##### **4-3-1-4 coating**

#### **4-3-2 Semi-industrial and industrial**

##### **4-3-2-1 Machinery**

### **4-4 Quality Control**

#### **4-4-1 Prior to production, control of raw materials,**

#### **4-4-2 During production (hardness, dissolution)**

#### **4-4-3 Post-production (stability and bioavailability)**

### **4-5 Categories**

## **5- Capsules**

### **5-1 Generalities**

#### **5-1-1 Definition and history**

#### **5-1-2 Advantages and disadvantages**

#### **5-1-3 Types**

#### **5-1-4 Features**

### **5-2 formulation**

#### **5-2-1 Capsules' components**

#### **5-2-2 Factors affecting the formulation**

### **5-3 Overview of manufacturing**

#### **5-3-1-1 Hard Capsules**

#### **5-3-1-2 Soft capsules**

#### **5-3-1-3 Microencapsulation**

#### **5-3-2 Semi-industrial and industrial**

##### **5-3-2-1 Machinery**

### **5-4 Control**

#### **5-4-1 Prior to production**

#### **5-4-2 During production**

#### **5-4-3 Post-production (Stability, bioavailability)**

### **5-5 Packing**

## **SOURCES**

- 3. Remington's Pharmaceutical Sciences**
- 4. Encyclopedia of Pharmaceutical Technology ( some chapters)**
- 5. Drug Information, a Guide to Current Resources; Bonnie Snow; 1989**
- 6. Introduction to Pharmaceutical Dosage Forms and Drug Delivery Systems, Anset, 1995.**

## **ASSESSMENT METHOD**

- 1. Mid-term exam (essay and multiple choice) 40%**
- 2. Final exam (essay and multiple choice) 60%**

**COURSE NAME:** Pharmaceutics 2 (solids)

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITES:** Pharmaceutics 1

### **GENERAL AIMS**

- 1) Practical familiarity with the methods of manufacturing of pharmaceutical powders.
- 2) Practical familiarity with the methods of manufacturing tablets and capsules

### **COURSE DESCRIPTION**

Methods of making solid products, and the use of devices such as tablets and capsules and other solid medicines in the extent laboratory and pilot training will be given.

### **LEARNING OUTCOMES**

- 1) Students should be able to prepare a variety of pharmaceutical powders for consumption.
- 2) Students must know all the steps manufacturing tablets and capsules

### **CONTENT**

- 1) Powders
- 2) Granulation
  - Dry
  - Wet
- 3) Tablet manufacturing
- 4) Sugar coating
- 5) Capsule manufacturing
- 6) Microcapsules
- 7) manufacturing Capsules
- 8) Polarization methods

## **SOURCES**

- 1. Remington's Pharmaceutical Sciences**
- 2. Encyclopedia of Pharmaceutical Technology ( some chapters)**
- 3. Drug Information, a Guide to Current Resources; Bonnie Snow; 1989**
- 4. Introduction to Pharmaceutical Dosage Forms and Drug Delivery Systems, Anset, 1995**

## **ASSESSMENT METHOD**

- 1. Final exam: 20%**
- 2. Work report and formulation 80%**

**COURSE NAME:** Pharmaceutics 3 (liquid and injectable)

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITE:** Pharmaceutics 2

### **GENERAL AIMS**

Students' familiarity with Pharmaceutical systems as suspension solutions, emulsions and injectable suspensions.

### **COURSE DEFINITION**

Manufacturing methods of solution and sterile products, and also the factors involved in the formulation of liquid products is discussed.

### **LEARNING OUTCOMES**

- 1) Students need to know a variety of soluble drugs and methods of their manufacturing.
- 2) Student need to know the manufacturing methods and methods involved In the preparation of soluble products, suspensions and emulsions.
- 3) The student knows components used in the formulation of injectable products.
- 4) Students should know the methods of manufacturing and types of injection products.

### **CONTENT**

- 1) Solutions
  - Generalities, advantages and disadvantages, Absorption
  - Types of solutions (Syrups, mouthwash...)
  - Components and formulations
  - Manufacturing and control methods- packing
- 2) Suspension
  - Generalities, advantages
  - Manufacturing methods
  - Control, packing and
  - Biological Properties
- 3) Emulsions



## **Generalities, components and formulations**

### **Surfactants and their types**

- **Factors affecting formulation**
- **Methods of manufacturing, control, packing.**

#### **4) Microemulsions**

- **Definition**
- **The difference with macro emulsion**
- **Features and manufacturing methods**

#### **5) Sterile Products**

- **Injectable**
- **Generalities, definitions, advantages and disadvantages.**
- **Components and formulation of injectable products**
- **Components and formulation of serums**
- **Methods of manufacturing, control**
- **Sterile Products for ears and eyes**
- **Components of products**

## **SOURCES**

- 1. Remington's Pharmaceutical Sciences**
- 2. Encyclopedia of Pharmaceutical Technology ( some chapters)**
- 3. Drug Information, a Guide to Current Resources; Bonnie Snow; 1989**
- 4. Introduction to Pharmaceutical Dosage Forms and Drug Delivery Systems, Anset, 1995**

## **ASSESSMENT METHOD**

- 1. Final exam (essay and multiple- choice): 90%**
- 2. Work report: 10%**

**COURSE NAME: Pharmaceutics3**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: Pharmaceutics2**

### **GENERAL AIMS**

- Familiarizing students with solution preparation
- Familiarizing students with emulsion
- Familiarizing students with sterile products production

### **COURSE DESCRIPTION**

Preparation of liquid and injectable products and use of devices to make these products

### **LEARNING OUTCOMES**

Students must:

1. Be able to make different solutions
2. Know how to make emulsions
3. know how to make sterile products

### **CONTENT**

1. lotion
2. syrup
3. suspension
4. dry and liquid emulsion
5. ampule
6. eye solution

### **SOURCES**

1. Remington's Pharmaceutical Sciences
2. Pharmaceutics; Aulton
3. The Theory and Practice of Industrial Pharmacy; Lachmann

4. **Pharmaceutical Practice; Aulton**
5. **Introduction to Dosage Forms and Drug Delivery System; Ansel**
6. **Encyclopedia of Pharmaceutical Sciences; Swarbrick**

#### **ASSESSMENT METHOD**

1. **Final exam 20%**
2. **Work report and drug preparation 80%**

**COURSE NAME:** Pharmaceutics4 (semi-solids)

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmaceutics3

### **GENERAL AIMS**

Familiarizing students with drug delivery in the form of aerosols and semi-solids

### **COURSE DEFINITION**

Fundamentals of formulation of semi-solid drugs such as aerosols, creams, ointments and gels, and the important factors in controlling these products in all production stages

### **LEARNING OUTCOMES**

1. Students must know aerosols
2. Know all semi-solid products
3. Know how to evaluate and control semi-solids

### **CONTENT**

1. Aerosol
  - 1-1- Introduction. Benefits and harms, different types ( DPI, MDI)
  - 1-2- Absorption( topical, systemic)
    - 1-2-1- Dermal
    - 1-2-2- Epithelial
    - 1-2-3- Oral
  - 1-3- Formulation
  - 1-4- Factors affecting formulation
    - 1-4-1 Device
    - 1-4-2 Drugs
    - 1-4-3 Patients
  - 1-5- Production methods
    - 1-5-1 Lab
    - 1-5-2 Industry
  - 1-6- Control

- 1-6-1 before
- 1-6-2 in vitro
- 1-6-3 after
- 1-7- Packaging
- 1-8- In vivo

## **2. Semi-solid products**

- 2-1 Fundamentals, advantages, disadvantages and types
- 2-2 Dermal and epithelial absorption
- 2-3 Parts and formulations
- 2-4 Factors affecting formulation
- 2-5 Types of semi-solid products
  - 2-5-2 creams
  - 2-5-2 ointments
  - 2-5-3 gels

## **SOURCES**

- 7. Remington's Pharmaceutical Sciences
- 8. Pharmaceutics; Aulton
- 9. The Theory and Practice of Industrial Pharmacy; Lachmann
- 10. Pharmaceutical Practice; Aulton
- 11. Introduction to Dosage Forms and Drug Delivery System; Ansel
- 12. Encyclopedia of Pharmaceutical Sciences; Swarbrick

## **ASSESSMENT METHOD**

- 1. Midterm exam (essay type and multiple choice) 40%
- 2. Final exam (essay type and multiple choice) 60%

**COURSE NAME: Pharmaceutics4 (semi-solids)**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: Pharmaceutics3**

### **GENERAL AIMS**

**Familiarizing students with methods to make different semisolid products such as ointments, creams and suppositories**

### **COURSE DESCRIPTION**

**Using the theoretical learnings to make semi-solid products like suppositories, ointments and the instruments used to make these drugs**

### **LEARNING OUTCOMES**

**Students must**

- 1. be able to make ointments**
- 2. be able to make creams**
- 3. be able to make ointments**

### **CONTENT**

- 1. ointment preparation**
- 2. cream preparation**
- 3. paste preparation (toothpaste)**
- 4. suppository preparation**

### **SOURCES**

- 1. Remington's Pharmaceutical Sciences**
- 2. Pharmaceutics; Aulton**
- 3. The Theory and Practice of Industrial Pharmacy; Lachmann**
- 4. Pharmaceutical Practice; Aulton**
- 5. Introduction to Dosage Forms and Drug Delivery System; Ansel**

**6. Encyclopedia of Pharmaceutical Sciences; Swarbrick**

**ASSESSMENT METHOD**

- 1. Final exam 20%**
- 2. Work report and product preparation 80%**

**COURSE NAME:** Pharmaceutics5 (Novel Systems)

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmaceutics4

### **GENERAL AIMS**

Familiarizing students with sterile drug delivery systems, novel pharmaceutical systems and targeted delivery

### **COURSE DEFINITION**

Due to the progress in pharmaceutical sciences and introduction of novel drugs to the market this course covers these drugs (peptide and protein) and the tools and substances that control absorption of these drugs.

### **LEARNING OUTCOMES**

Students must:

1. Know the fundamentals of making novel drugs and delivery systems
2. Know protein and peptide drugs

### **CONTENT**

1. Familiarizing student with new drug delivery systems
  - 1-1- Fundamentals, history, types, advantages and disadvantages
  - 1-2- Fundamentals of designing novel pharmaceutical systems
  - 1-3- Fundamentals of polymer and release mechanisms
- 2- Implanted drug delivery systems
- 3- Injectable drop-wise delivery systems
- 4- Peptide and protein delivery systems
- 5- Targeted drug delivery systems
- 6- Colon targeted drug delivery systems



## **SOURCES**

- 1. Remington's Pharmaceutical Sciences**
- 2. Pharmaceutics; Aulton**
- 3. The Theory and Practice of Industrial Pharmacy; Lachmann**
- 4. Pharmaceutical Practice; Aulton**
- 5. Introduction to Dosage Forms and Drug Delivery System; Ansel**
- 6. Encyclopedia of Pharmaceutical Sciences; Swarbrick**

## **ASSESSMENT METHOD**

**Multiple choice and essay type test 100%**

**COURSE NAME: Cosmetics**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Theoretical**

**PREREQUISITE: Pharmaceutics4**

### **GENERAL AIMS**

Familiarizing students with different types of cosmetic products (effect mechanisms, formulations and the functions of each ingredient), knowing skin, hair and nail structures and the use of these products.

### **COURSE DESCRIPTION**

Having sufficient knowledge of cosmetic products is central to a pharmacist's work and therefore students are familiarized with these products and making them.

### **LEARNING OUTCOMES**

**Student must:**

- 1. Know formulation substances and cosmetic production technologies**
- 2. Know substitute substances for some formulation compounds**
- 3. Know creams, lotions and the differences between products**

### **CONTENT**

- 1. Know skin, hair and nail physiology and the importance of water in skin hydration**
- 2. Different creams and lotions such as moisturizer, lightening, softener and foundation**
- 3. Sunscreen products, sun burn mechanisms**
- 4. Shampoos, their different types, evaluations and bath products**
- 5. Depilatory products, mechanisms and formulations**
- 6. Cleansing products and soaps**
- 7. Dentifrices**
- 8. Hair, hair fall, hair color and formulations**
- 9. Pediatric products**
- 10. Face mask, anti-wrinkle products and scrubs**

## **SOURCES**

- 1. Balsam N.S and Suguin E, Cosmetic Science and Technology (last edition), Volume 1,2,3**
- 2. Harry R.G; Cosmeticology: George Goodwin (last edition)**
- 3. Cosmetic Formulary, Wilkenson J.B Moor**
- 4. Barry B.W, Dermatological Formulation**
- 5. Skin and Skin Care Products; Dr. Masood Adrangi**
- 6. Cosmetic Products, Isfahan University of Medical Sciences, 1373; Dr. Seyed Manouchehr Aravi**

## **ASSESSMENT METHOD**

- 1. Multiple choice exam**
- 2. Final exam**
- 3. Seminars on novel cosmetic products**

**COURSE NAME: Pharmacotherapy1**

**NUMBER OF CREDITS: 3**

**COURSE TYPE: Theoretical**

**PREREQUISITES: Pharmacology2 and Physiology2**

### **GENERAL AIMS**

**Familiarizing students with pharmacotherapy of the disease based on pathophysiological, pharmacokinetic and pharmacological principles**

### **COURSE DESCRIPTION**

**One of the major roles of the pharmacist is to provide doctors with efficient guidance in the area of pharmacotherapy. Therefore in this course students are familiarized with diseases, symptoms, diagnostic methods and therapy.**

### **LEARNING OUTCOMES**

**Students must:**

- **Know epidemiological properties of each disease**
- **Know the applications and interpretations of diagnostic tests**
- **Know pathophysiological properties of diseases**
- **Know the symptoms of diseases**
- **Know therapeutic measures for each disease**
- **Know similar or substitute therapies for each disease**
- **Know the importance of economy in pharmacotherapy**
- **Know evidence based pharmacotherapy**
- **Know Irritations and drug side effects**

### **CONTENT**

- 1. Fundamentals, introduction**
- 2. Heart diseases**
- 3. Infectious diseases**
- 4. Immune disorder**

## **SOURCES**

- 1. Applied Therapeutics; Kodo-Kilmbel, Last Edition**
- 2. Pharmacotherapy: N Approach, A Pathophysiological Approach, Last Edition, Dipiro Hasted**
- 3. Comprehensive Pharmacy Review**
- 4. Clinical Pharmacy, Last Edition**
- 5. Harrison**
- 6. Cecil**
- 7. Current Therapy; Conn's**

## **ASSESSMENT METHOD**

- 1. Multiple choice and essay type exam 80%**
- 2. Seminar 20%**

**COURSE NAME: Pharmacotherapy2**

**NUMBER OF CREDITS: 3**

**COURSE TYPE: Theoretical**

**PREREQUISITES: Pharmacotherapy1**

### **GENERAL AIMS**

**Familiarizing students with pharmacotherapy of the disease based on pathophysiological, pharmacokinetic and pharmacological principles**

### **COURSE DEFINITION**

**One of the major roles of the pharmacist is to provide doctors with efficient guidance in the area of pharmacotherapy. Therefore in this course students are familiarized with diseases, symptoms, diagnostic methods and therapy.**

### **LEARNING OUTCOMES**

**Students must:**

- **Know epidemiological properties of each disease**
- **Know the applications and interpretations of diagnostic tests**
- **Know pathophysiological properties of diseases**
- **Know the symptoms of diseases**
- **Know therapeutic measures for each disease**
- **Know similar or substitute therapies for each disease**
- **Know the importance of economy in pharmacotherapy**
- **Know evidence based pharmacotherapy**
- **Know Irritations and drug side effects**

### **CONTENT**

- 1. Lung diseases**
- 2. Gastrointestinal disease**
- 3. Psychological diseases**
- 4. Neurological diseases**
- 5. Eye and ear diseases**

## **RESOURCES**

- 1. Applied Therapeutics; Kodo-Kilmbel, Last Edition**
- 2. Pharmacotherapy: N Approach, A Pathophysiological Approach, Last Edition, Dipiro Hasted**
- 3. Comprehensive Pharmacy Review**
- 4. Clinical Pharmacy, LastEdition**
- 5. Harrison**
- 6. Cecil**
- 7. Current Therapy; Conn's**

## **ASSESSMENT METHOD**

- 8. Multiple choice and essay type exam 80%**
- 9. Seminar 20%**

**COURSE NAME: Pharmacotherapy3**

**NUMBER OF CREDITS: 3**

**COURSE TYPE: Theoretical**

**PREREQUISITES: Pharmacotherapy2**

### **GENERAL AIMS**

**Familiarizing students with pharmacotherapy of the disease based on pathophysiological, pharmacokinetic and pharmacological principles**

### **COURSE DESCRIPTION**

**One of the major roles of the pharmacist is to provide doctors with efficient guidance in the area of pharmacotherapy. Therefore in this course students are familiarized with diseases, symptoms, diagnostic methods and therapy.**

### **LEARNING OUTCOMES**

**Students must:**

- **Know epidemiological properties of each disease**
- **Know the applications and interpretations of diagnostic tests**
- **Know pathophysiological properties of diseases**
- **Know the symptoms of diseases**
- **Know therapeutic measures for each disease**
- **Know similar or substitute therapies for each disease**
- **Know the importance of economy in pharmacotherapy**
- **Know evidence based pharmacotherapy**
- **Know Irritations and drug side effects**

### **CONTENT**

- 1. Kidney diseases**
- 2. Skin diseases**
- 3. Bone diseases**
- 4. Gynecological disease**
- 5. Blood disease**



6. Cancer
7. Children infectious diseases

## **SOURCES**

1. Applied Therapeutics; Kodo-Kilmbel, Last Edition
2. Pharmacotherapy: N Approach, A Pathophysiological Approach, Last Edition, Dipiro Hasted
3. Comprehensive Pharmacy Review
4. Clinical Pharmacy, Last Edition
5. Harrison
6. Cecil
7. Current Therapy; Conn's

## **ASSESSMENT METHOD**

10. Multiple choice and essay type exam 80%
11. Seminar 20%

**COURSE NAME:** Pharmacoeconomics and Pharmaceutical management

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Mathematics

### **GENERAL AIMS**

Familiarizing students with management and economics topics related to pharmacy administration.

### **COURSE DESCRIPTION**

Due to the fact that providing pharmaceutical services in a pharmacy and other health care centers requires having knowledge of basic economic concepts and cost and benefit calculation, this course entails these topics in addition to accounting and Islamic economics.

### **LEARNING OUTCOMES**

Students must:

1. Know principles of economics and economic systems.
2. Know health systems and pharmacy establishing processes.
3. Have knowledge of accounting, insurance and related issues.
4. Be able to form medical record folders and retrieve them

### **CONTENT**

1. Principles of economics, definitions, supply and demand, economic balance, economic growth
2. Islamic economics: different economic mechanisms and comparisons, Islamic economics and characterizations, Islamic economic terms
3. Economics in health systems, economic growth in health systems, the effects of economic management on health indicators, cost analysis
4. Cost -effectiveness, cost-benefit
5. The importance of economics in pharmacy
6. Accounting
7. Investment management, cashier, goods, characterizations of a good manager

## **8. Risk management**

### **SOURCES**

- 1. Reminton's Pharmaceutical sciences**
- 2. Pharmaceutical Management**
- 3. Reningron's Pharmaceutical sciences**
- 4. Behavior Management; Zamani**

### **ASSESSMENT METHOD**

**Essay type test and case discussion and Seminar**

**COURSE NAME:** Technical English

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** General English

### **GENERAL AIMS**

- Familiarizing students with different branches of pharmaceutical sciences in English
- Knowing the role of the pharmacist in pharmacy
- Familiarizing students with research areas of pharmaceutical sciences

### **COURSE DESCRIPTION**

Methods to use English texts related to pharmaceutical sciences and the technical literature are taught in this course.

### **LEARNING OUTCOMES**

The student must be able to discuss different subjects related to pharmaceutical sciences in English.

### **CONTENT**

1. Pharmacy and its evolution
2. Community pharmacy
3. Drug therapy
4. Pharmaceutical care
5. Role of enzyme in drug metabolisms
6. Mechanisms of drug actions
7. Computer in pharmacy
8. Pharmaceutical research
9. Pharmaceutical chemistry
10. Drug poisoning

**11. Drug abuse**

**12. Pharmaceutical biotechnology**

## **SOURCES**

**English for Students of Pharmacy**

## **ASSESSMENT METHOD**

- 1. Team work 20%**
- 2. Conversation 30%**
- 3. Essay type and multiple choice assessment**

**COURSE NAME:** Terminology in Pharmacy and Medicine

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Technical English

### **GENERAL AIMS**

1. Familiarizing students with common words in medical sciences
2. Familiarizing students with common suffixes and prefixes

### **COURSE DESCRIPTION**

Definitions of common words in medical sciences, suffixes and prefixes

### **LEARNING OUTCOMES**

Students must:

1. Know pharmacy terminology
2. Know how to use suffixes and prefixes
3. Know phrases and words used in medical sciences

### **CONTENT**

1. General principles of word formation
2. Abbreviations and their use in medicine and pharmacy
3. Adjectives and nouns pertaining to the body as a whole (prefixes, suffixes)
4. General principles of nomenclature of diseases and disorders and their diagnosis and surgical treatment

### **SOURCES**

1. Suitable medical terminology books containing exercises

2. Remington; the sciences and practice of pharmacy, chapter one
3. English For Students of Pharmacy

#### **ASSESSMENT METHOD**

1. Team work 20%
2. Essay type and multiple choice test 80%

**COURSE NAME:** Food and Therapeutic Regimen

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Analytical Chemistry, Fundamental Biochemistry

### **GENERAL AIMS**

1. Familiarizing students with the role of therapeutic diets in diseases and the mutual interactions of drugs and foods and the results of these interactions
2. Familiarizing student with the effects of nutrition on health, and the diseases resulting from malnutrition

### **COURSE DESCRIPTION**

Classifications of additives and their pharmaceutical effects, different types of therapeutic diets and the mutual interactions between food and drug (absorption and kinetics)

### **LEARNING OUTCOMES**

1. Know different additives and their toxic effects
2. Know different therapeutic diets
3. Know the effects of malnutrition on drugs
4. Know the effects of foods and interactions with drugs

### **CONTENT**

1. Food additives ( vitamins, amino acids, minerals)
2. Diet therapy
  - a. Metabolic disorders
  - b. phenylketonuria
  - c. galactosmia
  - d. Maple syrup
3. Diet therapy in cardiovascular diseases(vessel blockage, hypertension)
4. Diet in diabetes
5. Diet in cancer, AIDS, injuries
6. Risk factors in food- drug interactions



7. The effects of food and nutrition on metabolism and distribution
8. The effects of protein-energy malnutrition on drugs
9. The effects of drinks on drugs
  - Milk, alcohol
10. Metabolic cycles and the effects of drugs on each cycle
11. Electrolytes and drug effects
12. Food antioxidants and their therapeutic effects

## **SOURCES**

1. Basic Nutrition and Diet Therapy; Rabinson 1993
2. Remington's Pharmaceutical Sciences
3. Food Composition; A. Edwin, Martion. R 1987

## **ASSESSMENT METHOD**

**Essay type and multiple choice test 100%**

**COURSE NAME:** Biopharmacy and Pharmacokinetics

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Mathematics, Biological Statistics, Pharmaceutics 5, pharmacology 2

### **GENERAL AIMS**

Familiarizing students with dosage form destination in body and the factors influencing them (physicochemical properties, the effects of formulation changes and physiological properties (the effects of age, gender, disease, genetics, nutrition)).

### **COURSE DESCRIPTION**

Because of the importance of drug destination in body, the study of absorption processes and the different pharmacokinetic models and parameters are covered in this course.

### **LEARNING OUTCOMES**

Students must:

1. know membrane structure and transfer mechanisms
2. know the factors influencing transfer
3. know different pharmacokinetic models.
4. Know different pharmacokinetic parameters

### **CONTENT**

1. Membrane structure and transfer mechanisms
2. Factors influencing transfer:
  - a. Physicochemical factors
  - b. Physiological factors
  - c. Factors influencing drug formulation
3. Pharmacokinetics
4. Determining pharmacokinetic parameters through intravenous injection

- a. From urine sample
- b. Renal clearance
- c. Liver clearance
- d. Metabolism
- e. Nonlinear pharmacokinetics
- f. TD.M

## **SOURCES**

1. Applied Biopharmaceutics and Pharmacokinetics; Leon Shargel and Andrew
2. Biopharmaceutics and Clinical Pharmacokinetics; Mito- Gibaldi
3. Clinical Pharmaceutics; Rowland and Tozor

## **ASSESSMENT METHOD**

1. Exercise 20%
2. Essay type test 70%
3. Seminar 10%

**COURSE NAME:** Biological Products

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Immunology

### **GENERAL AIMS**

1. Familiarizing students with the definition of biological products
2. Familiarizing students with the concepts of making biological products using old and new methods.
3. Familiarizing students with different types of biological products, use and storing methods

### **LEARNING OUTCOMES**

Students must:

1. Know the definition of biological products
2. Know the types of biological products
3. know how to prepare bacterial and viral vaccines
4. know immunomodulator compounds
5. know different serums and toxoids
6. know novel vaccines

### **CONTENT**

1. immunologic concepts
2. antigen and antibody structure
3. classifications and definitions of biologic products , storing methods
4. basic principles making vaccines and immunoglobulin
5. bacterial vaccines
6. serums and immunoglobulin
7. toxoids
8. antitoxin and antivenin
9. viral vaccines

## **10. immunomodulators**

### **SOURCES**

- 1. Remington Biologics**
- 2. Pharmacognosy and pharmacobiotechnology; Tyler**

### **ASSESSMENT METHOD**

- 1. Multiple choice test 40%**
- 2. Essay type test 40%**
- 3. Team work result 20%**

**COURSE NAME:** Cell Culture

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmaceutical Biochemistry

### **GENERAL AIMS**

- 1. Familiarizing students with cell and culture techniques**
- 2. Familiarizing students with the methods to use cultured cells and their application in pharmaceutical sciences**

### **COURSE DESCRIPTION**

Today much pharmaceutical research happens at cellular levels and drug effects are examined at cellular levels and therefore this course covers types of cell and cell life cycle.

### **LEARNING OUTCOMES**

Students must:

- 1. Know different types of cells and the factors influencing their culture and growth**
- 2. Know animal cellular structure**
- 3. Know the applications of cultured cells in pharmaceutical sciences.**

### **CONTENT**

- 1. History of cell culture and applications**
- 2. Factors influencing cell culture**
- 3. Cell individual life cycle**
- 4. Animal cell structure**
- 5. Biological needs and the vital processes of animal cells**
- 6. Sterilization methods and cell culture lab equipment**
- 7. Cell culture media and contents**
- 8. Short-long term animal cell storing animal cell biochemical quantification**
- 9. Applications of cell culture in pharmaceutical and pharmacological research**

## **SOURCES**

- 1. Animal cell culture, R.I. Fresheng, 1992, Oxford University Press**
- 2. Large Scale Cell Culture, B.K, Lydersen; Hanser Publishers**
- 3. Epithelial Cell Culture, A.J. Shaw, Oxford University Press**

## **ASSESSMENT METHOD**

**Essay type and multiple choice test 100%**

**COURSE NAME:** Microbial Control of Drugs

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Microbiology and Pharmaceutics 1-5

### **GENERAL AIMS**

Familiarizing students with drug microbial contamination, the hazards of using contaminated drugs, contamination prevention, and antimicrobial drug protection and evaluation methods.

### **COURSE DESCRIPTION**

One of the most important points that should be considered when preparing and storing, quality assurance and preventing drug microbial contamination, and therefore methods to identify drug microbial contaminations and preventing them are taught in this course.

### **LEARNING OUTCOMES**

Students must:

1. Know the application of microbiology in product microbial control and be able to use microorganisms in microbial control experiments.
2. Know the principles of product microbial assurance in factory and be able to do microbial assurance experiments in factory.
3. Know the principles of microbial control of sterilized unsterilized products and be able to perform the related experiments
4. Know the principles of antimicrobial protection.
5. Be able to identify rotten pharmaceutical products
6. Know the principles of potency determination of antibiotics, vitamins and amino acids using microorganisms.
7. Know evaluation principles of antimicrobial compounds and MIC and MBC determination



## **CONTENT**

- 1. Microbiological quantifications and antibiotics and vitamins potency determination**
- 2. Determination of MIC and MBC of antimicrobial compounds**
- 3. Microbial control of products while being made**
- 4. Antimicrobial protection systems**
- 5. Product microbial contamination**
- 6. Microbial control of unsterilized products**

## **SOURCES**

- 1. Microbial Quality Assurance; R.M Baird with S.F Bloomseld (1995-1996)**
- 2. Guide to Microbiological Control in Pharmaceuticals; C. Denger**
- 3. Pharmaceutical Microbiology W.B Huco, A.D Russel**
- 4. Microbiological Quality Assurance, Dr. Kamal**
- 5. Pharmaceutical Microbiology; Dr. Sadigheh Bazaz**
- 6. Remington's Pharmaceutical sciences**

## **ASSESSMENT METHOD**

- 1. Essay type and multiple choice test 90%**
- 2. Report and class participation 10**

**COURSE NAME:** Microbial Control of Drugs

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITE:** Microbiology and Pharmaceutics 1-5

### **GENERAL AIMS**

Familiarizing students with drug microbial contamination, the hazards of using contaminated drugs, contamination prevention, and antimicrobial drug protection and evaluation methods.

### **COURSE DESCRIPTION**

Identifying microbial contaminations, and microbial control of pharmaceutical products will be practically thought in this course.

### **LEARNING OUTCOMES**

1. Know the application of microbiology in product microbial control and be able to use microorganisms in microbial control experiments.
2. Know the principles of product microbial assurance in factory and be able to do microbial assurance experiments in factory.
3. Know the principles of microbial control of sterilized unsterilized products and be able to perform the related experiments
4. Know the principles of antimicrobial protection.
5. Be able to identify rotten pharmaceutical products
6. Know the principles of potency determination of antibiotics, vitamins and amino acids using microorganisms.
7. Know evaluation principles of antimicrobial compounds and MIC and MBC determination

### **CONTENT**

1. Lyophilized ampoule opening test and microorganism culture
2. Protective agent effectiveness test

3. Total viable count (TVC)
4. Sterility testing
5. Antibiotic potency test using .... Method
6. Antibiotic potency test using Turbidimetric method
7. Minimum inhibitory concentration test (MIC)
8. Minimum bactericidal concentration test (MBC)
9. LAL test

## **SOURCES**

1. Microbial Quality Assurance; R.M Baird with S.F Bloomseld (1995-1996)
2. Guide to Microbiological Control in Pharmaceuticals; C. Denger
3. Pharmaceutical Microbiology W.B Huco, A.D Russel
4. Microbiological Quality Assurance, Dr. Kamal
5. Pharmaceutical Microbiology; Dr. Sadigheh Bazaz
6. Remington's Pharmaceutical sciences

## **ASSESSMENT METHOD**

1. Lab work result 80%
2. End-of-term examination 20%

**COURSE NAME:** Physicochemical Control of Drugs

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** General Chemistry, Analytical Chemistry, Instrumental Analysis Methods

### **GENERAL AIMS**

Familiarizing students with drug quality, the physicochemical quality of raw materials and pharmaceutical products, principles of analysis protocols and quantification of raw materials and pharmaceutical products

### **COURSE DESCRIPTION**

Because of the indispensable role of the pharmacist in pharmaceutical industries, it is important to learn control and analysis methods, and therefore in this course students experiment sampling, analyzing different chemicals and determining the physicochemical stability of compounds.

### **LEARNING OUTCOMES**

1. Know analysis protocols and drug and raw material quantification
2. Be able to design analysis protocols if needed
3. Know sampling methods and sample preparation
4. Know the simple classic and instrumental analysis methods
5. Be able to interpret the data

### **CONTENT**

1. Principles of pharmaceutical physicochemical quality, standards and pharmacopeia
2. Pharmaceutical physicochemical quality, chemical properties, identity, quality or power and related tests
3. Principles of sampling, statistical methods of sampling from pharmaceutical products, sample preparation, extraction and purification methods
4. Analysis method evaluation
5. Classic drug analysis methods

6. **Pharmaceutical tests related to drug formations ( like solubility time and speed of tablets)**
7. **Chemical stability of drugs and protocols of stability tests for raw materials and pharmaceutical products**
8. **Application of chemical methods in quantification of pharmaceuticals**
9. **Validation and quality assurance**

## **SOURCES**

1. **Pharmaceutical Analysis; Watson**
2. **Text Book of Pharmaceutical Analysis; Connor**
3. **USP and BP**
4. **Chemical Stability, a Hand Book for the Pharmacist**

## **ASSESSMENT METHOD**

1. **Team work and work report 20**
2. **Essay type or multiple choice test: 80%**

**COURSE NAME:** Physicochemical Control of Drugs

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITE:** General Chemistry, Analytical Chemistry, Instrumental Analysis Methods

### **GENERAL AIMS**

Familiarizing students with different methods of pharmaceutical physicochemical tests to quantify active ingredients and compound stability tests.

### **COURSE DESCRIPTION**

Performing physicochemical tests on pharmaceutical and non-pharmaceutical compounds and different drugs in the market and quantification of materials in different pharmaceutical products using analysis devices are of the main topics taught in this course.

### **LEARNING OUTCOMES**

Students must:

1. Know different methods to quantify the active ingredients using standard methods
2. Know methods to separate the active ingredients from other ingredients
3. Know how to quantify active ingredients in different dosage forms

### **CONTENT**

1. Experiment1: Identification, potency and purity test on aspirin
2. Experiment2: Identification, potency and purity test on salicylic acid
3. Experiment3: Identification, potency and purity test on ascorbic acid
4. Experiment4: Identification and quantification tests on indomethacine capsule
5. Experiment5: Physicochemical control test on dextrose saline
6. Experiment6: physicochemical control of dextrose saline

7. **Experiment7: separation and identification of Aspirin- Codeine Phosphate tablet ingredients**
8. **Experiment8: quantification of Estradiol valerate in intravenous solution through UV**
9. **Experiment9: quantification of hydrochloride Pilocarpine in eye drop**
10. **Experiment10: Quantification of Metocarbamol in injectable solution through IR**
11. **Experiment11: Analysis method validation, (Diclofenac quantification through UV)**
12. **Experiment 12: dosage units and uniformity tests on Fenobarbital 100 and 150 tablets**

## **SOURCES**

1. **Pharmaceutical Analysis; Watson**
2. **Text Book of Pharmaceutical Analysis; Connor**
3. **USP and BP**
4. **Chemical Stability, a Hand Book for the Pharmacist**

## **ASSESSMENT METHOD**

1. **Presenting experiment results and related calculations 80%**
2. **Work report 20%**

**COURSE NAME: Biostatistics**

**NUMBER OF CREDITS: 2**

**COURSE TYPE: Theoretical**

**PREREQUISITES: Mathematics**

### **GENERAL AIMS**

**Familiarizing students with concepts and applications of statistics in different areas of medical sciences, particularly research.**

### **COURSE DESCRIPTION**

**Statistics quantify the quality of communities, help understand situations better and facilitate scientific analyses. Quantifying the value and validity of research projects and decision making is not possible without the science of statistics.**

### **CONTENT**

- 1. Definition of statistics**
- 2. Distribution and definition**
- 3. Probability**
- 4. Time distribution**
- 5. Estimation**
- 6. Variance analysis**
- 7. Health indicators**
- 8. Epidemiological studies and analyses**
- 9. Applications of statistics in medical sciences**
- 10. Optimization**

### **SOURCES**

- 1. Statistical Methods and Health Indicators; Dr. Kazem Mohammad, Dr. Malek Afzali**
- 2. Pharmaceutical Statistics, Bultun**



### **3. Pharmaceutical Experimental Design; Luis**

#### **ASSESSMENT METHOD**

**Work report and essay type test 100%**

**COURSE NAME: Biostatistics**

**NUMBER OF CREDITS: 1**

**COURSE TYPE: Practical**

**PREREQUISITES: Mathematics**

### **GENERAL AIMS**

**Familiarizing student with statistical software such as SPSS to do statistical analyses in medical research**

### **COURSE DESCRIPTION**

**Experimental sciences with mathematical foundations can be evaluated. Besides knowledge of statistics, the student must be able to choose the suitable statistical software in different research topics and know how to use the software.**

### **CONTENT**

- 1. Introduction of common statistical software**
- 2. Statistical test choice**
- 3. working with the data**
- 4. questionnaire data**
- 5. graphs and charts**
- 6. data coding**
- 7. dependent and independent mean comparison**
- 8. variance analysis**

### **SOURCES**

**Handbook of SPSS; Dr. Akbar Fotouhi**

### **ASSESSMENT METHOD**

**Statistics project including analysis 100%**

**COURSE NAME:** Instrumental Methods of Analysis

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Analytical Chemistry, Organic Chemistry

### **GENERAL AIMS**

1. familiarizing student with the laws and principles of instrumental quantification
2. gaining proficiency in identification and quantification of pharmaceuticals
3. preparation for the courses of quality control and physicochemical quality assurance of pharmaceuticals
4. preparation for research theses in different areas of pharmaceutical sciences

### **COURSE DESCRIPTION**

Drug analysis and quantification of materials in pharmaceutical product are not possible without high technology analysis devices, therefore learning the theories based on which these devices work is of the topics covered in this course.

### **LEARNING OUTCOMES**

1. know the principles and applications of each instrumental method
2. know the principles of identification and quantification of chemical and pharmaceutical compounds using the devices.

### **CONTENT**

1. intro and method classification
2. principles of spectroscopy
3. molecular spectroscopy (UV, fluorescence, IP, ...)
4. atomic spectroscopy
5. electrochemical methods
6. separation methods
7. NMR
8. Mass

## **SOURCES**

- 1. Chromatography; Dr. Abbas Shafei**
- 2. Review on Spectroscopy;**
- 3. Fundamentals of Analytical Chemistry; Scoog-West**
- 4. Introduction to chemical Analysis; Mc Graw 1993**

## **ASSESSMENT METHOD**

- 1. Essay type test 10%**
- 2. Multiple choice test 80%**
- 3. Seminar 10%**

**COURSE NAME:** Instrumental Methods of Analysis

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITE:** Analytical Chemistry and Organic Chemistry

### **GENERAL AIMS**

Familiarizing students with identification, purification and chemical structure identifiers

### **COURSE DESCRIPTION**

Using analysis devices to separate and identify different compounds, and choosing and correct use of the devices

### **LEARNING OUTCOMES**

Students must:

1. Extraction methods and equipment
2. Know principles of using different analysis devices
3. Know how to prepare chemicals to work with the equipment

### **CONTENT**

1. Spectroscopy UV
2. Spectroscopy IR
3. NMR
4. Refractometry
5. Florometry
6. Polarography
7. Polarimetry
8. GC
9. HPLC

## **SOURCES**

- 1. Chromatography; Dr. Abbas Shafei**
- 2. Review on Spectroscopy;**
- 3. Fundamentals of Analytical Chemistry; Scoog-West**
- 4. Introduction to chemical Analysis; Mc Graw 1993**

## **ASSESSMENT METHOD**

- 1. Work result and interpretations 80%**
- 2. Work report 20%**

**COURSE NAME:** Pharmaceutical Biotechnology

**NUMBER OF CREDITS:** 3

**COURSE TYPE:** Theoretical

**PREREQUISITE:** Molecular Biology and Genetics

### **GENERAL AIMS**

1. Familiarizing student with the principles of drug production using biotechnological techniques
2. Familiarizing students with use of microbial sources in pharmaceutical compound production

### **COURSE DEFINITION**

Due to the progress of biotechnology in pharmaceutical sciences and the emergence of novel drugs made using new complicated technologies, it seems inevitable for pharmacy students to build a foundation about uses and processes of these products with this course.

### **LEARNING OUTCOMES**

Students must:

1. Know how to use microbes to produce pharmaceutical compounds
2. Know production methods and sources of biotechnological pharmaceutical products
3. Know the equipment used in biotechnological pharmacy

### **CONTENT**

1. Definition, history and applications of biotechnology in medical sciences
2. Biotechnological equipment
3. Microorganism culture, growth graph
4. Different culture methods
5. Biological products and production processes
  - Antibiotics, enzymes, novel products, organic acids, anti-cancers
6. Purification methods
7. Production of industrial microorganisms and an intro to microbial collections

## **8. Biotransformation**

### **SOURCES**

- 1. Microbial Biotechnology; Dr. Fereydoun Malek Zadeh; Tehran University Publications**
- 2. Industrial Biotechnology; Dr. Shoja Sadat**

### **ASSESSMENT METHOD**

**Essay type and multiple choice test 100%**



**COURSE NAME:** Introductory Pharmacy Practice Experience

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Practice Experience

**PREREQUISITES:** Pharmacotherapy<sup>3</sup> and Pharmacology<sup>2</sup>

### **GENERAL AIMS**

- Familiarizing students with OTC and Prescription drugs
- Familiarizing student with common dosage forms in Iran pharmaceutical market
- Familiarizing with prescription reading, dispensing and the related laws ( including health insurance laws)
- Developing effective relations with patients and medical staff and providing them with pharmaceutical guidance.

### **COURSE DESCRIPTION**

One of the most significant factors in the field of pharmacy and an important responsibility of the pharmacist is providing guidance in pharmacotherapy; therefore acquiring knowledge of diseases and disease physiopathology is of high priority. In this course different diseases, symptoms and diagnostic methods are covered.

### **LEARNING OUTCOMES**

**Students must:**

- Know different common dosage forms and storing methods in pharmaceutical pharmacies and storage rooms
- Know the required scientific references in a pharmacy and know how to use them
- Know prescription reading and dispensing
- Know how to interact with patients and medical staff
- Know correct methods of pricing, buying a franchise

## **CONTENT**

**(Each session is equivalent to 6 hours)**

- **Different dosage forms (3 sessions)**
- **Shelving drugs and dosage forms (1 session)**
- **Drugs that must be stored in refrigerator and their special storing approaches (1 session)**
- **Prescriptions and the information they reveal (1 session)**
- **Insurance laws (1 session)**
- **Prescription pricing rules(1 session)**
- **References in pharmacy (1 session)**
- **Dispensing and practice experience, interaction with patients and the staff (12 sessions)**

## **SOURCES**

- **AHSF, last edition**
- **Martin Dale, last edition**
- **Facts and Comparison, last edition**
- **USPDI (for patients and health care providers) last edition**
- **Pharmaceutical Calculations; JI Zats, last edition**
- **Pharmaceutical Rules and Regulations in Iran, last edition**

## **ASSESSMENT METHOD**

- 1. Written evaluation 40%**
- 2. Practical evaluation (student participation) 20%**
- 3. Oral evaluation 40%**

**COURSE NAME:** Introductory Industry Practice Experience

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Practice Experience

**PREREQUISITES:** Simultaneously with Pharmaceutics 5

### **GENERAL AIMS**

Learning the production processes and the qualitative and quantitative tests in drug mass production, LP, GMP

### **COURSE DESCRIPTION**

One of the main activities of pharmacists is working as technicians in pharmaceutical companies, and therefore in this course students are familiarized with pharmaceutical company work and the different parts of factories.

### **LEARNING OUTCOMES**

Students must:

1. Know ingredients storing methods and conditions
2. Know packaging units
3. Know formulation design and mass production of pharmaceutical products

### **CONTENT**

- General knowledge of pharmaceutical companies and the responsibilities ( meetings with company authorities and work report)
- Visiting different storage rooms ( ingredient storage and packaged drugs storage, quarantine, spare parts... and work report)
- Different packaging units ( liquids, injectable and non-injectable, semi-solids and solids ... and work report)
- Production processes of different dosage forms
- Qualitative control processes including physicochemical, microbiological and biological control
- Research on formulation design and improvement of the existing formulations

## **SOURCES**

**F.D.A, W.H.O and ICI guidelines**

## **ASSESSMENT METHOD**

**Work report and interpretation 100%**

**COURSE NAME:** Urban Pharmacy Advanced Practice Experience

**NUMBER OF CREDITS:** 6

**COURSE TYPE:** Advanced Practice Experience

**PREREQUISITES:** -

### **GENERAL AIMS**

- Acquiring proficiency to work as therapy consultants to patients and medical staff
- Acquiring knowledge of OTC drugs and prescribing them
- Acquiring knowledge of derivative drug formation
- Learning order placement and purchasing goods from companies
- Relations between pharmacies and insurance companies

### **COURSE DESCRIPTION**

Using the materials learned in pharmacy internship and other issues like placement of orders and drug purchase

### **LEARNING OUTCOMES**

Students must:

1. Be able to interact with patients
2. Be able to evaluate prescriptions, regarding adverse effects, toxic reactions and how to take the medication
3. Know how to use all dosage forms ( ointments, drops, eye and nose creams, suppositories, tablets and rectal and vaginal creams)
4. Know how to report side effects of a drug
5. Know how to order and purchase from distributing companies
6. Be able to use computer software to make insurance lists
7. Be able to transfer information and advice to patients
8. Be able to compound drugs

### **CONTENT**

(Each session is equivalent to 6 hours)

- Placement of orders to distributing companies (1 session)

- **Software required for pharmacy work (1 session)**
- **Prescription evaluation principles (1 session)**
- **OTC drugs (1 session)**
- **Common compounded drugs (1 session)**
- **How to use different dosage forms (1 session)**
- **ADR and report (1 session)**
- **Advanced Practice Experience (306 hours)**

## **SOURCES**

- **AHSF, last edition**
- **Martin Dale, last edition**
- **Facts and Comparison, last edition**
- **USPDI (for patients and health care providers) last edition**
- **Pharmaceutical Calculations; JI Zats, last edition**
- **Pharmaceutical Rules and Regulations in Iran, last edition**

## **ASSESSMENT METHOD**

- 1. Written exam 30%**
- 2. Practical evaluation (presence in sessions) 20%**
- 3. Proficiency exam 50%**

**COURSE NAME:** Hospital Pharmacy Advanced Practice Experience

**NUMBER OF CREDITS:** 6

**COURSE TYPE:** Advanced Practice Experience

**PREREQUISITES:** -

### **GENERAL AIMS**

- Familiarizing students with clinical and lab manifestations of common diseases
- Familiarizing students with disease pharmacotherapy and monitoring principles
- Teaching the methods to record the required information related to pharmaceutical services

### **COURSE DESCRIPTION**

Because of the important role of the pharmacist in the health cycle, it is necessary for a pharmaceutical scientist to be able to interact with patients and guide doctors.

### **LEARNING OUTCOMES**

Students must:

- Know clinical symptoms of diseases
- Know pharmacotherapy for common diseases
- Know how to provide patients and doctors with pharmaceutical advice
- Know how to monitor and prevent adverse effects
- Know the principles of prescribing P-drug and how to monitor responses to treatment

### **CONTENT**

- An introduction to Clinical Pharmacy (1 session)
- Familiarization to hospital and different wards (1 session)
- Presence in hospital in five of the following wards based on student choice or availabilities
  - a. Internal: Nephrology
  - b. Lung
  - c. Heart

- d. Glands
- e. Blood, Oncology
- f. Rheumatology
- g. Digestion
- h. Neurology, Psychology
- i. Infection
- j. ICU or CCU
- k. Skin
- l. Gynecology (female students)
- m. General surgery
- n. Pediatrics
- Offering consultation to released patients (2 weeks)
- Presence in sterile room and preparing injectable solutions (2 weeks)

## **SOURCES**

1. Interpretational laboratory data
2. Applied Therapeutics, Last Edition
3. Pharmacotherapy, Dipiro, Last Edition
4. Internal Medicine, Cecil, Last Edition
5. Internal Medicine Harrison, Last Edition
6. AHFS

## **ASSESSMENT METHOD**

1. Written exam 35%
2. Practical evaluation 30%
3. Oral evaluation 35%



**COURSE NAME:** Industry Advanced Practice Experience

**NUMBER OF CREDITS:** 6

**COURSE TYPE:** Advanced Practice Experience

**PREREQUISITES:** -

### **GENERAL AIMS**

**Complementary studies, GMP, GIP, System Validation**

### **COURSE DESCRIPTION**

**Build and understanding of all the processes in a pharmaceutical manufacturing company including ingredient purchase, storing these ingredients till the last stage of production and selling the products.**

### **LEARNING OUTCOMES**

- **Student must be able to comment on product storage**
- **Students must know test methods, production processes and validation approaches**

### **CONTENT**

- 1. Meeting and consulting heads of different factory units**
- 2-5. Complementary study of different storage rooms and preparing report**
- 6-9. Visiting the packaging unit and preparing report**
- 15-20. Visiting production units and preparing report**
- 21-30. visiting quality control units**
- 31-34. visiting research units including synthetic and plant-based drugs and cosmetics**
- 35-37. visiting the technical units of the factory, machines and devices maintenance, ventilation systems...**
- 38-40. visiting administrative units and preparing report**

## **SOURCES**

**Rules of F.D.A and W.H.O**

## **ASSESSMENT METHOD**

**Analytical work report on the different production processes**

**COURSE NAME:** Radipharmacy

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Medicinal Chemistry and Pharmacology2

## **GENERAL AIMS**

Familiarizing students with:

1. Principles and fundamentals of isotope use in researches done in different pharmaceutical and medical areas
2. Principles of isotope use in disease diagnosis

## **LEARNING OUTCOMES**

Students must:

1. know isotope characteristics
2. know the principles of isotope use in research and therapy
3. know the devices used to identify and quantify isotopes
4. be able to compare the use of isotopes in diagnosis and therapy with other methods

## **CONTENT**

1. fundamentals of Radio Physics (atom structure, forces affecting atom structure, nuclides, atom stability, radioactivity)
2. radioactive processes (alpha, beta, gamma decay, radioactive balance, stable balance, half- life)
3. Nuclear reactors, radio chemistry, radioactive waste and waste management, radio isotope enrichment and radio chemical purification, ...)
4. Intro to radio medicine and its use
5. Fundamentals of radiation protection

## **SOURCES**

1. Textbook of Radiopharmacy, Theory and practice; 3<sup>rd</sup> edition, C.B Sampson (1992)
2. Fundamentals of Nuclear Pharmacy C.B Sana (1997)
3. The Handbook of Radio Pharmaceuticals; A. Owanwanne, M. Patel, S. Sadek (1995)

#### **ASSESSMENT METHOD**

1. Essay Type Test 75%
2. Multiple choice test 155
3. Seminar 10%

**COURSE NAME:** Plant Cell Culture

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmacognosy 2

### **GENERAL AIMS**

**Familiarizing student with the principles of plant cell culture and production of secondary metabolites**

### **LEARNING OUTCOMES**

**Students must:**

- **Know plant cell culture principles**
- **Know all culture media**
- **Know effective factors in cell culture**
- **Know uses of biochemical changes**
- **Know the factors effective on production of secondary metabolites**

### **CONTENT**

- **Plant Biotechnology**
- **Intro and history**
- **Plant cell culture types**
- **Plant cell culture use**
- **Plant cell culture lab**
- **Methods used in plant cell culture lab**
- **Compounds used in cell culture media**
- **Effective factors**
- **Obstacles and limitations**
- **Metabolite production increase**
- **Elicitors and secondary metabolite production**

### **SOURCES**

- **Fundamentals of plant tissue culture; Dr. Soleyman Afsharipoor, Isfahan University of Medical Sciences Publication, 1372**
- **Pharmacognosy, Trace ; Saunder Publications' 1996**

## **ASSESSMENT METHOD**

**Multiple choice test 100%**

**COURSE NAME:** Plant Cell Culture

**NUMBER OF CREDITS:** 1

**COURSE TYPE:** Practical

**PREREQUISITES:** Theoretical Plant Cell Culture

### **GENERAL AIMS**

- Familiarizing students with culture methods and devices used
- Different methods of storing the cells, culture contamination and culture health examination

### **LEARNING OUTCOMES**

**Students must:**

1. Know the equipment used in cell culture
2. Know methods of cell culture, cell storage and passage
3. Know the applications of different substances in culture

### **CONTENT**

1. Cell culture lab
2. Learning the theory and practice and maintenance of cell culture equipment
3. Cell culture lab sterilization methods
4. Culture media preparation and maintenance
5. Suspension cell culture
6. Trypan Blue staining method
7. Phenol Red staining method
8. Enzyme identification method to examine cell health
9. Quantification of cell glutathione

### **SOURCES**

1. Animal Cell Culture, I, R Fresheng; 1992, Oxford University
2. Large Scale Cell Culture, B. K Shaw, Oxford University Press

## **ASSESSMENT METHOD**

- 1. Work report and presentation of results 80%**
- 2. Multiple choice test 20%**



**COURSE NAME:** Traditional Medicine

**NUMBER OF CREDITS:** 2

**COURSE TYPE:** Theoretical

**PREREQUISITES:** Pharmacognosy 2

### **GENERAL AIMS**

- Familiarizing student with the fundamentals of traditional and complementary medicine
- Familiarizing students with different practices of complementary medicine
- Familiarizing students with plant-based drugs and their production in traditional medicine
- 

### **LEARNING OUTCOMES**

**Students must:**

1. Know the fundamentals of traditional and complementary medicine
2. Know Iranian traditional medicine practitioners
3. Know different practices of complementary medicine

### **CONTENT**

1. Fundamentals of traditional and complementary medicine
2. History of traditional medicine
3. Greek medicine
4. Medicinal plants
5. Complementary medicine
6. Traditional pharmacy
7. Production of plant based drugs in traditional medicine

### **SOURCES**

1. History of Medicine in Iran; volume 1,2
2. Encyclopedia of Natural Healing, Woodham and Peter
3. A Textbook of Natural Medicine, Pizzorno and Murray

## **ASSESSMENT METHOD**

- 1. Essay type and multiple choice test 80%**
- 2. Seminar 20%**

# **Chapter Four**

## **Curriculum Evaluation**

### **Evaluation Objectives:**

- Ensuring achievement of the ideal, general and final goals of the curriculum
- Examining the practical accordance of the curriculum with the designed strategies
- Developing more advanced strategies to progress the determined goals
- Optimized use of abilities and opportunities
- Improving weaknesses and turning threats into opportunities

### **Practical Processes of the Curriculum Evaluation**

- Designing study approaches
- Determining evaluation indicators
- Determining quantitative values and ranking
- 
- Work report

### **Evaluation Frequency**

- Frequent evaluation done by educational departments based on the ideas of students and professors
- General evaluations each ten years

### **Suggested Indicators for Curriculum Evaluation**

- Supervision on curriculum execution in Pharmacy schools
- Quantity and quality control of provided Pharmaceutical services in health care cycles on different levels
- Managerial abilities in the pharmaceutical system, from decision making to execution.
- Job opportunities and changes
- Opportunities of participation in entrance exams of higher educational levels
- Students' satisfaction
- Lecturers' satisfaction
- Examining the extent to which pharmacy schools follow the content of the curriculum

**Curriculum success criteria for each indicator**

- An 80 percent coordination between presentation and execution of the curriculum by pharmacy schools is deemed satisfactory.
- A 50 percent qualitative and quantitative achievement of the desired pharmaceutical services in different levels of the healthcare cycle is deemed satisfactory.