

In the Name of God

Section I:

Title: Pharmacy

Degree: Doctor of Pharmacy (Pharm.D.)

Introduction

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. The School of Pharmacy is equipped with educational and research laboratories in pharmacognosy, pharmaceuticals, instrumental analysis, pharmacology, toxicology, pharmaceutical biotechnology, medicinal chemistry, microbial control, physico-chemical analysis and medicinal plants. 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 the society.

Definition

Doctor of pharmacy (Pharm.D.) is a field in medical sciences, designed to meet the pharmacy-related medical needs of the society. The School's curriculum provides students with the opportunity to develop their skills both in theory and practice. The curriculum provides graduates with the opportunity to work in industrial and pharmaceutical companies, quality control laboratories, poison control centers, cosmetic companies, cellular pharmacology, herbal medicine, biotechnology research, and academia.

The Aim of the Course

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.

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.

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.

General Competencies

It is essential for pharmacy students to have good written and oral communication skills. Students must be able to communicate effectively with patients, physicians, and with other members of the health care team. The final applicant pool may be interviewed.

Specific Competencies and Skills (Special Qualifications)

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, they can provide doctors with information, performing research on drug use patterns, and endemics.
2. In research areas of institutions and pharmaceutical companies.

The Terms and Conditions of Admission to the Course

All applicants must apply electronically on our website www.gsia.ac.ir. After an application is submitted, the applicant will receive a confirmation e-mail and an application code from the Office of Admissions indicating successful submissions of the application.

If any part of the application is incomplete, our admission coordinator will request the missing information and mark the application incomplete until the requested information is submitted. The completed application form is reviewed in the preliminary review council (PRC).

Once the initial preliminary review council (PRC) has made a decision, the application will be sent to the School and the related department, for an Admission Review.

If you have requested or applied for a scholarship, your application is also forwarded to the Scholarship Committee.

Selection Criteria for Undergraduate Applicants

- Academic grade point average (GPA): Minimum 300/400,
- Proficiency in English: Acceptable TOEFL or IELTS score (IELTS of 5.5 or equivalent is required upon graduation <http://gsia.tums.ac.ir/page-2305.hm>,
- Evidence of intellectual or creative achievement or substantial public service,
- Special talents, achievements, and awards in particular fields,
- Experiences that demonstrate promise for leadership,
- Academic accomplishment in light of the applicant's life experiences and special circumstances,
- Please also include an English translation for all documents.

NOTE: In addition to meeting the selection criteria outlined above, applicants might be asked to participate in an interview.

Educational Strategies, Methods, and Techniques Pharmacy

Education lasts approximately 5-6 years for Pharm.D. degree. This degree requires a high school diploma. Successful students can opt to achieve a Pharm.D. (Pharmacy Doctor) degree. Pharmacy students study basic sciences for 2 years and then continue in specialized courses.

Student Assessment

Students should take part in the end-of-term exams for each module separately. Some lecturers may decide to take an additional mid-term exam. The pass criteria for each exam is 50% of the total mark. However, if the average mark for all exams taken in each term is less than 12/20, the student's admission to the next term would be conditional in which a reduced number of modules could be taken. Repetitive conditional admission may result in student being expelled from the Pharmacy program.

Number and Type of Credits and Tables of the Courses

Total Number of Credits: 194

General Courses: 10

Fundamental Courses: 44

Specialized: 114

Introductory Practice Experience: 6

Advanced Practice Experience: 12

Thesis: 8

Pharmacy- 1st semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	General Chemistry	3		3	
2	General Chemistry (Lab.)			1	1
3	Medical Terminology	2		2	
4	First Aid1	1	2		
5	Anatomy & Histology	2		2	
6	Anatomy& Histology (Lab.)			1	1
7	General Biology 2			2	
8	Pharmaceutics (Introduction)	2			2
9	Maths for Pharmacist	2		2	
10	Persian Language I	2		2	
11	Physical Training I		1	1	
	Total	16	3	20	

Pharmacy- 2nd semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Organic Chemistry I	3		3	
2	Biochemistry	3		3	
3	Biochemistry (Lab.)		1	1	
4	Medical Microbiology I	3		General Biology 3	
5	Medical Microbiology I (Lab.)			1	1
6	Physical Pharmacy I	2		2	
7	Physiology I	4		Anatomy & Histology	4
8	Persian Language II	2		2	
9	Physical Training II		1	1	
	Total	17	2	20	

Pharmacy- 3rd semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Analytical Chemistry	2		2	
2	Analytical Chemistry (Lab.)		2		2
3	Physiology II	4		Physiology I	4
4	Physiology II (Lab.)		1	Physiology I	1
5	Medical Microbiology II	2		Medical Microbiology I	2
6	Medical Microbiology II (Lab.)		1	Medical Microbiology I	1
7	Physical Pharmacy II	2		Physical Pharmacy I	2
8	Organic Chemistry II	3		Organic Chemistry I	3
9	Organic Chemistry (Lab.)		1	Organic Chemistry I	1
10	Epidemiology	2		2	
	Total	15	5	20	

Pharmacy- 4th semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Immunology	3		3	
2	Immunology (Lab.)		1		1
3	Clinical Biochemistry	2		Biochemistry	2
4	Pharmacology I	3		Physiology, Biochemistry	3
5	Medical Devices	1		1	
6	Biostatistics	2	1	3	
7	Medicinal Chemistry I Pharmacology I	3		General Chemistry, Organic Chemistry,	
8	Nutraceuticals & Nutrition Care	2		Biochemistry, Analytical Chemistry	
	Total	16	2	18	

Pharmacy- 5th semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Pharmaceutics (Solid Dosage Forms)	3	1	Pharmaceutics (Introduction)	4
2	Pharmacology II	3	1	Pharmacology I	4
3	Sociology	2			2
4	Medicinal Plants 2	1			3
5	Medicinal Chemistry II	3		Medicinal Chemistry I, Pharmacology II	3
6	Biological Products	2		Immunology	2
7	Ethics in Pharmacy	1			1
	Total	16	3		19

Pharmacy- 6th semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Pharmaceutics (Liquid Dosage Forms)	3	1	Pharmaceutics (Solid Dosage Forms)	4
2	Pharmacology III	3		Pharmacology II	3
3	Pharmacognosy I	2		Medicinal Plants 2	
4	Medicinal Chemistry III	3		Medicinal Chemistry II, Pharmacology III	3
5	Medicinal Chemistry (Lab.)		1		1
6	Pharmacotherapy I	3		Pharmacology III	3
7	Psychology	2			2
8	Community Pharmacy Training I		2	Pharmacology III	2
	Total	16	4		20

Pharmacy- 7th semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Pharmaceutics (Semi-Solids & Inhalers)	2	1	Pharmaceutics (Introduction)	3
2	Pharmacotherapy II	3		Pharmacotherapy I	3
3	Pharmacognosy II	3		Pharmacognosy I	3
4	Pharmacognosy (Lab.)		2	Pharmacognosy I	2
5	Pharmaceutical Policy & Pharmaco-economics			2	2
6	Biopharmacy & Pharmacokinetics		3		Maths for Pharmacist, Pharmacology
III	3				
7	Community Pharmacy Training II			2	2
8	Thesis I	2		After 90 Credits	2
	Total	13	7		20

Pharmacy- 8th semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Instrumental Analytical Methods	3	1	Organic Chemistry, Analytical Chemistry	4
2	Hygiene & Cosmetic Products		2	Pharmaceutics (Semi-Solids & Inhalers)	2
3	Pharmacotherapy III	3		Pharmacotherapy II	3
4	Radiopharmaceuticals	2		2	
5	Industrial Training		2	Pharmaceutics (Semi-Solids & Inhalers)	2
6	Hospital Pharmacy Training		2	Pharmacotherapy III	2
7	Toxicology	2	1	Pharmacology III	3
8	Thesis II		2	Thesis I	2
	Total	12	8		20

Pharmacy- 9th semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Microbial Control 3	2	1	Medical Microbiology II, Pharmaceutics (Introduction)	
2	Pharmaceutical Biotechnology	3		General Biology 3	
3	Instrumental Analytical Methods (advanced) 3			2	1 Instrumental Analytical Methods
4	Drug and Chemical Poisoning Management First Aids 2			2	Toxicology, Pharmacology III,
5	Elective course	2		Relevant to the Thesis	2
6	Pharmaceutics (Novel Drug Delivery Systems & Inhalers) 3			2	1 Pharmaceutics (Semi-Solids &
7	Thesis III		2		2
	Total	15	5		18

Pharmacy- 10th semester

	Subject	Number of credits		Total credits	
		Credit (theory)	Credit (practical)	prerequisite	
1	Physico-chemical Control Analytical Methods 3	2	1	General Chemistry, Analytical Chemistry, Instrumental	
2	Community Pharmacy Internship Pharmacotherapy III 6			6	Community Pharmacy Training II ,
3	Clinical Internship 6*			6*	Community Pharmacy Training II , Pharmacotherapy III
4	Industrial Internship			6*	Industrial Training 6*
5	Elective course	2			2
5	Thesis IV	2		Thesis III	2
	Total	4	15*		19*

* Students may choose either clinical or industrial internship.

Pharmacy- Elective Courses

Subject	Credit	Subject	Credit
Advanced Medicinal Chemistry	2	Nutritional materials (Chemistry and control)	2
Hospital Pharmacy	2	Biopharmacy (lab.)	1
Clinical pharmacy	2	Plant cell culture	2
Phytochemistry	2	Animal cell culture	2
Traditional and alternative medicine	2	Drug/poisoning information services	2

Ethical issues

The graduates should:

- Observe the Patient's Bill of Rights¹ when working with the patients.
- Strictly observe Biosafety and Patient Safety Rules* concerning the patients, personnel, and workplace.
- Observe the Rulebook for Dress Code².
- Strictly observe the Regulations of Working with the Laboratory Animals³.
- Carefully preserve resources and equipment.
- Truly respect faculty members, the staff, classmates, and other students and work for creating an intimate and respectful atmosphere.
- Observe social and professional ethical considerations in criticism.

1, 2, and 3 are contained in the Enclosures.

* Biosafety and Patient Safety Rules will be set out by the Educational Departments and will be available to the students.

Section II

COURSE NAME: Maths for Pharmacist

NUMBER OF CREDITS: 2

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: General Chemistry

NUMBER OF CREDITS: 3

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, etc.)**
- 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 1st to 5th 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: 1

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: General Biology

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 the 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: 1

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. 1st 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 I

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, E₂ reactions, cis and anti reduction**
- Alkyl Halides:**
 - Substitution reactions, SN1 and SN2, 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 protons and polarity, suitable solvent for S_N1 and S_N2 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 relatability 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 5th ed.; Allyn and Bacon, Inc.; 1987
2. Bacon, J.D.; Caserio, M.C.; Basic Principles of Organic Chemistry; 2nded.;W.A. Benjamin, Inc.; 1977.
3. Ege, S.N.; Organic Chemistry; 2nded,; D.C Health and Company; 1989
4. Wade, L.G.; Organic chemistry 2nd ed.; prentice-Hall, Inc.;1991

ASSESSMENT METHOD

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

COURSE NAME: Organic Chemistry

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 fracture 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 5th ed.; Allyn and Bacon, Inc.; 1987
2. Bacon, J.D.; Caserio, M.C.; Basic Principles of Organic Chemistry; 2nded.; W.A. Benjamin, Inc.; 1977.
3. Ege, S.N.; Organic Chemistry; 2nded.; D.C Health and Company; 1989
4. Wade, L.G.; Organic chemistry 2nd 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 II

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Organic Chemistry I

GENERAL AIMS:

Familiarizing students with the characterizations of organic materials classifications, nomenclature, synthesis reactions, and the reaction of each organic matter group.

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:

4. Be able to classify and name organic materials and know the physical and chemical characterizations of each group.
5. Be able to explain synthesis processes of each of the organic material group and the related reaction mechanisms.
6. 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 5th ed.; Allyn and Bacon, Inc.; 1987
2. Bacon, J.D.; Caserio, M.C.; Basic Principles of Organic Chemistry; 2nded.; W.A. Benjamin, Inc.; 1977.
3. Ege, S.N.; Organic Chemistry; 2nded.; D.C Health and Company; 1989
4. Wade, L.G.; Organic chemistry 2nd ed.; prentice-Hall, Inc.; 1991

ASSESSMENT METHOD

1. Essay type test: 90%
2. Oral presentation: 10%

COURSE NAME: 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: 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 I

NUMBER OF CREDITS: 4

COURSE TYPE: Theoretical

PREREQUISITES: Anatomy & Histology

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**
 - **Anatomo-physiology 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, etc.**
4. **Physiology of respiration**
 - **Anatomo-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 II

NUMBER OF CREDITS: 4

COURSE TYPE: Theoretical

PREREQUISITES: Physiology I

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
 - Anatomophysiology 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 II
NUMBER OF CREDITS: 1
COURSE TYPE: Practical
PREREQUISITES: Physiology I

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 para-clinic 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

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.

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 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**

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: Medical Devices

NUMBER OF CREDITS: 1

COURSE TYPE: theoretical

PREREQUISITES: -

GENERAL AIMS

Familiarizing students with different medical devices used in first aid, resuscitation approaches, and other areas.

COURSE DESCRIPTION

Different devices are used in the medical care units and would be covered in this course.

LEARNING OUTCOMES

Students must:

- Know the devices used in first aids.
- Know devices used in cardiac and respiratory resuscitation.
- Know the use of different medical equipment.

CONTENT

1. Medical equipment

SOURCES

Principles of First Aids; last edition

Britain Red Cross, Guide to First Aids

Translator: Samimizad

ASSESSMENT METHOD

3. Final exam: 50%
4. Practical performance of the methods: 50%

COURSE NAME: Medical Microbiology I

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: General Biology

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: Medical Microbiology I

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITES: -

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: Medical Microbiology II

NUMBER OF CREDITS: 1

COURSE TYPE: Theoretical

PREREQUISITES: Medical Microbiology I

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 life cycles 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 hydatid, *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*, *Streptomyces rhodotorula*), *Malassezia furfur*, *Carnobacterium*, *Mocoro candidis*, *Ectothrix*, *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: Medical Microbiology II

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITES: Medical Microbiology I

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: -

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 electrophoresis.
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. Vejgani

ASSESSMENT METHOD

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

COURSE NAME: Epidemiology

NUMBER OF CREDITS: 1

COURSE TYPE: Theoretical

PREREQUISITES: -

GENERAL AIMS

Familiarizing students with epidemiology principles.

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 epidemiology and 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 processes, and perception.

COURSE DESCRIPTION

Knowing the basic principles of psychology and 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
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: 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**
- **Prophyrins**

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 I

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 II

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Pharmacognosy I

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: Pharmacognosy II

NUMBER OF CREDITS: 2

COURSE TYPE: Practical

PREREQUISITES: Pharmacognosy I

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 and 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 I

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Organic Chemistry, Biochemistry

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) Quinolone
- 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 II

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Medicinal Chemistry I

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. Cholinergics and anticholinergics.

2. **Anticholinesterases**
3. **Histamine and antihistamines**
4. **Anesthetics**
5. **Adrenergic and antiadrenergic**
6. **Thyroid drugs**
7. **Diuretics**
8. **Hypothalamus and hypophysis hormones**
9. **Antihypertensive drugs**
10. **Anticoagulants**
11. **Antihyperlipidemics**
12. **Cardiac glycosides**
13. **ACE inhibitors.**
14. **Adrenocorticoids**
15. **Estrogen and antiestrogens**
16. **Androgen and antiandrogens**
17. **Anabolics**
18. **Antidiabetics**

SOURCES:

1. **William O. Foye, Thomas L. Lemke, David A Williams**
2. **Principles of Medicinal Chemistry, Williams and Wilkins; U.S.A 1995.**
3. **James N. Delgado, Williams A. Remer, Wilson and Gisvold's text book of Organic Medicinal and Pharmaceutical Chemistry, J.B Lippincott Company**
4. **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 III

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Medicinal Chemistry I

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 MAD 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) **Anti-Epileptic 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: Medicinal Chemistry

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITES: Organic Chemistry I

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

ASSESSMENT METHOD

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

COURSE NAME: Pharmacology I

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Physiology II, Biochemistry

GENERAL AIMS:

students' familiarity with autonomic nervous system drugs, pharmacodynamics, drugs on neuromuscular transmission, pain medications, antibiotics, digestive system drugs, skin medications, and the mechanism of these drugs.

COURSE DESCRIPTION:

Considering the fact that one of the most vital and important parts of pharmacy education is familiarity with medications and how they work, 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

- o **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) **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**
- 5) **Skin medications**
- 6) **Gastrointestinal Drugs**
- 7) **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 II

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Pharmacology I

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 parts of pharmacy education is familiarity with medications and how they work, 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) **Nonsteroidal anti-inflammatory medications, non-narcotic pain medications, and anti-gout**
- 2) **local anesthetic**
- 3) **Narcotic pain medications and their antagonists**
- 4) **Drug abuse**
- 5) **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**
- 6) **Respiratory drugs (anti-asthma, cough medicine, etc.)**
- 7) **Adrenocorticoids**
- 8) **Hormones**

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 III

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Pharmacology I

GENERAL AIMS

To 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, 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

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

Respiratory drugs(anti-asthma, cough medicine)

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

Drugs used for blood disorders

- Medications used for anemia
- Drugs used in coagulation disorders

Medications affecting the endocrine system:

- The hypothalamus-pituitary hormones
- Drugs used in hypothyroidism and hyperthyroidism
- Pancreatic hormones and medications used for diabetes

Drugs used for cancer

Principles of gene therapy

Immunopharmacology

Drugs used for skeletal disorders

Drugs interactions

Drug allergies and idiosyncrasy

SOURCES

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

ASSESSMENT METHOD

4. Essay type exam: 60 %
5. Multiple choice exam: 30%
6. Oral presentation: 10%

COURSE NAME: Toxicology

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: Pharmacology III

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: 1

COURSE TYPE: Practical

PREREQUISITES: Pharmacology III

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: Drug and Chemical Poisoning Management

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: Toxicology – Pharmacology III 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 I

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: -

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 pharmaceuticals.
- 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

Midterm exam (essay and multiple choice): 30%

Final exam (essay and multiple choice): 40%

Problem solving: 30%

COURSE NAME: Physical Pharmacy II

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: Physical Pharmacy I

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 (Introduction)

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: Pharmaceutics (Solid Dosage Forms)

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Pharmaceutics (Introduction)

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, and powders.

CONTENT

1. Pharmaceutical Operations
 1. Mixing
 2. Mitting
 - 1-2-1 particle size decrease
 - 1-2-2 Particle size distribution
 - 1-2-3 measuring the diameter of the particles
 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

1. Advantages and disadvantages of powders and granules

2. Types

3. Manufacturing technology

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. **Midterm exam (essay and multiple choice): 40%**
2. **Final exam (essay and multiple choice): 60%**

COURSE NAME: Pharmaceutics (Solid Dosage Forms)

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITES: Pharmaceutics (Introduction)

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 (Liquid Dosage Forms)

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITE: Pharmaceutics (Solid Dosage Forms)

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, etc.)**
- **Components and formulations**
- **Manufacturing and control methods, packing**

2) Suspension

- **Generalities and advantages**
- **Manufacturing methods**
- **Control, packing, etc.**
- **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: Pharmaceutics (Liquid Dosage Forms)

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITES: Pharmaceutics (Solid Dosage Forms)

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: Pharmaceutics (Semi-Solids and Inhalers)

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: Pharmaceutics Introduction

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

8. In vivo

2. Semi-Solid products

1. Fundamentals, advantages, disadvantages, and types

2. Dermal and epithelial absorption

3. Parts and formulations

4. Factors affecting formulation

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: Pharmaceutics (Semi-Solids and Inhalers)

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITES: Pharmaceutics Introduction

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: Pharmaceutics (Novel Drug Delivery Systems)

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: Pharmaceutics (Semi-Solids and Inhalers)

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. **Fundamentals, history, types, advantages, and disadvantages**
 2. **Fundamentals of designing novel pharmaceutical systems**
 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: Hygiene and Cosmetic Products

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITE: Pharmaceutics (Semi-Solids and Inhalers)

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, lightning, 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, Wilknsn 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: Pharmacotherapy I

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Pharmacology III

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, Dipro 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: Pharmacotherapy II

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: Pharmacotherapy III

NUMBER OF CREDITS: 3

COURSE TYPE: Theoretical

PREREQUISITES: Pharmacotherapy II

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: Pharmaceutical Policy and Pharmaco-Economics

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: -

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. **Reiningron's Pharmaceutical sciences**
4. **Behavior Management; Zamani**

ASSESSMENT METHOD

Essay type test and case discussion and seminar

COURSE NAME: Medical Terminology

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: -

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, 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: Nutraceuticals and Nutrition Care

NUMBER OF CREDITS: 2

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: Maths for pharmacist, Pharmacology III

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: Microbial Control

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: Medical Microbiology II and Pharmaceutics (Introduction)

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

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITE: Medical Microbiology II and Pharmaceutics (Introduction)

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

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: General Chemistry, Analytical Chemistry, Instrumental Analytical 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

NUMBER OF CREDITS: 1

COURSE TYPE: Practical

PREREQUISITE: General Chemistry, Analytical Chemistry, Instrumental Analytical 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: -

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: -

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 Analytical methods

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, florescence, IP, etc.)**
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 Analytical Methods

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, 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. **Fluorometry**
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: General Biology

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: Community Pharmacy Training I

NUMBER OF CREDITS: 2

COURSE TYPE: Practice Experience

PREREQUISITES: -

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 and 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: Industrial Training

NUMBER OF CREDITS: 2

COURSE TYPE: Practice Experience

PREREQUISITES: Pharmaceutics (Semi-Solids and Inhalers)

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: Community Pharmacy Internship

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: Clinical Internship

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: Industrial Internship

NUMBER OF CREDITS: 6

COURSE TYPE: Advanced Practice Experience

PREREQUISITES: -

GENERAL AIMS

Complementary studies, GMP, GIP, System Validation

COURSE DESCRIPTION

Building and understanding of all the processes in a pharmaceutical manufacturing company including ingredient purchase, storing these ingredients until 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: Radiopharmaceuticals

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: -

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, etc.)**
- 4. Intro to radio medicine and its use**

5. Fundamentals of radiation protection

SOURCES

- 1. Textbook of Radiopharmacy, Theory and practice; 3rd 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: 15%**
- 3. Seminar: 10%**

COURSE NAME: Cell Culture

NUMBER OF CREDITS: 1

COURSE TYPE: Theoretical

PREREQUISITES: -

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. 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 and 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: Plant Cell Culture

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: Pharmacognosy II

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: Traditional and Alternative Medicine

NUMBER OF CREDITS: 2

COURSE TYPE: Theoretical

PREREQUISITES: -

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.**
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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%**