Jordan University of Science and Technology

Faculty of Pharmacy

Study Plan of Bachelor Degree in Pharmacy

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Vision:

Achieving excellence in Pharmaceutical education and Pharmaceutical care.

Mission:

The preparation of competitive efficient pharmacists through a distinct academic environment, promising scientific research and productive community partnership.

Objectives:

1. To provide students with the comprehensive scientific knowledge and skills needed for future Pharmacists in different aspects of Pharmaceutical sciences.
2. To provide students with high-quality practical training to develop the students' skills in the field of Pharmacy practice.
3. To provide the students with special professional knowledge and ethics needed for the profession of Pharmacy.
4. Graduating students with significant Pharmaceutical skills and knowledge needed for the different career tracks available in the Pharmacy fields.

Job Opportunities:

1. Community and hospital Pharmacies.
2. Pharmaceutical marketing/Science liaisons.
3. Pharmaceutical Industry.
4. Food and Drug Administration.
5. Academia.
6. Pharmaceutical research and development.
7. Medical websites.
8. International and national health organizations.

Study Plan of Bachelor Degree in Pharmacy

Numbering and coding system of courses of the study plan.

Course Coding

The following codes are used to designate courses:

Faculty Specialization	Level/year	Field	Sequence
PHAR	x	y	z

Course Numbering

- The Pharmacy courses are tabled and numbered in such a manner to recognize each course regarding its subject area, year or level, and semester offered.
- Ex. PHARxyz: The **PHAR** symbol in the course number denotes Pharmacy specialization and (xyz) is a 3-digit number:

A. The first digit denotes the year level of the course according to the student's study plan as follows:

Code	Level/year
1	First
2	Second
3	Third
4	Fourth
5	Fifth

B. The second digit denotes the course field subject as follows:

Number	Specialization
0	Introductory and Basic Pharmaceutical Sciences
1	Clinical Pharmacy
2	Medicinal Chemistry and Pharmacognosy
3	Medicinal Chemistry and Pharmacognosy
4	Clinical Pharmacy
5	Pharmaceutical Technology
6	Clinical Pharmacy
7	Pharmaceutical Technology
8	Clinical Pharmacy
9	Clinical Pharmacy

C. The third digit denotes a sequence of the semester during which the course is offered according to the study plan. In a way, that the odd numbers are given to the first and summer semesters while even numbers are given to second semesters.

Example: PHAR446 Therapeutics 2 means:

PHAR	4	4	6
PHARMACY	Level (Fourth year)	Field (Clinical Pharmacy)	Sequence (Second semester)

D. (*) labeling at course name indicates it is an online course, while (#) indicates a Project-based course. Examples: PHAR566 Pharmaceutical Marketing *, and PHAR567 Toxicology #.

A Bachelor of Science (B.Sc.) degree in Pharmacy at JUST is awarded per the statute stated by JUST regulations for B.Sc. awarding issued by the Dean's Council based on the adjusted 1987 law for awarding scientific degrees and certifications at JUST after completing (162) credit hours successfully.
The study plan composed of the following:

Classification		Credit hours		
	Compulsory	Elective	Training	Total
University requirement	16	9	0	25
Faculty requirement	19	9	0	28
Specialty requirement	103	0	6	109
Total	138	18	6	162

A. University Requirements (25 Credit Hours)

1. Compulsory University Requirements: include (16 Credit Hours) that are studied by all university students.

2. Elective courses: include (9 credit hours).

B. Faculty Requirements: (28 credit hours) distributed as follows:

1. Mandatory courses (19 credit hours)

Course No.	Course title	Credit hours		Weekly practical hours	Prerequisite or co-requisite
		Theoretical	Practical		
HSS103BT	General Biology	3	-	-	-
BT107	General Biology Lab	-	1	2	HSS103BTor Co-requisite
HSS103CHEM	General Chemistry	3	-	-	-
CHEM107	General Chemistry Lab	-	1	2	HSS103CHEM or Co-requisite
CHEM262	Biochemistry	3	-	-	PHAR124
MED230A	Human Physiology	3	-	-	HSS103BT
MED372	Pathophysiology	3	-	-	MED230A
PH311	Biostatistics	2	-	-	PHAR122
Total		**17**	**2**	**4**	

2. Elective courses: Students must choose courses equivalent to (9) credit hours from the Faculty of Pharmacy elective courses as follows:

Course No.	Course title	Credit hours		Weekly practical hours	Prerequisite (or Co-requisite)
		Theoretical	Practical		
PHAR504A	Selected Topics (1)	1	-	-	Dean's approval
PHAR504B	Selected Topics (2)	2	-	-	Dean's approval
PHAR521	Introduction to Scientific Research	3	-	-	PHAR462
PHAR522	Drug Design #	3	-	-	PHAR433
PHAR523	Synthetic Medicinal Chemistry	3	-	-	PHAR433
PHAR524	Computer-Aided Drug Design#	3	-	-	PHAR433
PHAR525	Bioanalysis	3	-	-	PHAR433
PHAR526	Advanced Instrumental Analysis	3	-	-	PHAR433
PHAR527	Functional Foods and Nutraceuticals	3	-	-	PHAR433

PHAR528	Complementary and Alternative Medicine	3	-	-	PHAR433
PHAR529	Drug Discovery from Nature	3	-	-	PHAR433
PHAR531	Elemental Analysis of Medicines	3	-	-	PHAR433
PHAR532	Biosensors	3	-	-	PHAR433
PHAR533	Selected Topics in Pharmaceutical and Biomedical Analysis	3	-	-	PHAR433
PHAR534	Medical Laboratory Testing	3	-	-	PHAR463
PHAR535	Poisonous Plants	3	-	-	PHAR433
PHAR551	Nanotechnology	3	-	-	PHAR451
PHAR552	Advanced Pharmaceutical Biotechnology	3	-	-	PHAR452
PHAR553	Advanced Pharmaceutical Microbiology	3	-	-	PHAR452
PHAR554	Gene Therapy #	3	-	-	PHAR452
PHAR555	Cosmetic preparations	3	-	-	PHAR451
PHAR556	Stem Cell Therapy and Regenerative Medicine	3	-	-	PHAR452
PHAR557	Advanced Industrial Pharmacy	3	-	-	PHAR452
PHAR558	Vaccines Development and Formulations	3	-	-	PHAR452
PHAR559	Advanced Pharmacokinetics	3	-	-	PHAR452
PHAR586	Targeted Cancer Therapies	3	-	-	PHAR344
PHAR587	Drug Development: Introduction to Clinical Trials	3	-	-	PHAR344
PHAR588	Advanced Therapeutics	3	-	-	PHAR561
PHAR590	Advanced Pharmacology	3	-	-	PHAR344
PHAR591	Advanced Pharmacy Practice *	3	-	-	PHAR401
PHAR592	Pharmacoepidemiology *	3	-	-	PHAR462
PHAR593	Molecular Pharmacology	3	-	-	PHAR344
PHAR595	Pharmacogenetics	3	-	-	PHAR344
PHAR596	Hospital Pharmacy	3	-	-	PHAR401
PHAR597	Clinical Pharmacology	3	-	-	PHAR344
PHAR598	Pharmacy Management and Accounting	3	-	-	PHAR484
PHAR599	Public Health Toxicology	3	-	-	PHAR567

C. Program requirements (Pharmacy): (109) credit hours allocated from the Faculty of Pharmacy as follows:

1. Mandatory courses: (103) credit hours

Course No.	Course title	Credit hours		Weekly practical hours	Prerequisite (or Co-requisite)
		Theoretical	Practical		
PHAR122	Introduction to Pharmacy	1	-	-	HSS103BT
PHAR124	Pharmaceutical Organic Chemistry	3	-	-	HSS103CHEM
PHAR126	Pharmaceutical Analytical Chemistry	2	-	-	HSS103CHEM
PHAR221	Pharmaceutical Instrumental Analysis	3	-	-	PHAR126
PHAR224	Medicinal Chemistry 1	3	-	-	CHEM262 and PHAR124
PHAR226	Pharmaceutical Sciences Lab	-	1	2	PHAR224 or Co-requisite
PHAR242	Pharmacology 1	3	-	-	MED372 and PHAR122
PHAR251	Pharmaceutical Microbiology	3	-	-	MED230A
PHAR252	Pharmaceutics 1	3	-	-	PHAR221
PHAR323	Medicinal Chemistry 2	3	-	-	PHAR224
PHAR324	Medicinal Chemistry 3	3	-	-	PHAR323
PHAR334	Pharmacognosy and Phytochemistry	3	-	-	PHAR323
PHAR343	Pharmacology 2	3	-	-	PHAR242
PHAR344	Pharmacology 3	3	-	-	PHAR251 and PHAR343
PHAR345	Pharmacy Practice Lab	-	1	2	PHAR343 or Co-requisite
PHAR351	Pharmaceutics 2	3	-	-	PHAR252
PHAR353	Drug Compounding Lab 1	-	1	2	PHAR351 or Co-requisite
PHAR354	Pharmaceutics 3	3	-	-	PHAR351

PHAR355	Biopharmaceutics and Pharmacokinetics	3	-	-	PHAR252
PHAR356	Drug Compounding Lab 2	-	1	2	PHAR354 or Co-requisite
PHAR371	Pharmaceutical Biotechnology	3	-	-	PHAR351
PHAR372	Pharmaceutical Microbiology and Biotechnology Lab	-	1	2	PHAR371 or Co-requisite
PHAR433	Phytotherapy	3	-	-	PHAR334
PHAR445	Therapeutics 1	3	-	-	PHAR344
PHAR446	Therapeutics 2	3	-	-	PHAR445
PHAR447	Clinical Cases Lab 1	-	1	2	PHAR445 or Co-requisite
PHAR448	Clinical Cases Lab 2	-	1	2	PHAR446 or Co-requisite
PHAR451	Pharmaceutical Technology	3	-	-	PHAR354
PHAR452	Drug Delivery	3	-	-	PHAR451
PHAR461	Immunology and Vaccines	2	-	-	PHAR344
PHAR462	Drug Information and Clinical Literature Evaluation	3	-	-	PHAR445
PHAR463	Clinical Biochemistry	3	-	-	PHAR344
PHAR464	Public Health and Policy	3	-	-	PHAR461
PHAR482	Non-prescription Pharmaceuticals #	3	-	-	PHAR463
PHAR484	Simulation Pharmacy	-	1	2	PHAR482 or Co-requisite
PHAR561	Therapeutics 3	3	-	-	PHAR446
PHAR562	Clinical Nutrition	2	-	-	PHAR561
PHAR563	Clinical Cases Lab 3	-	1	2	PHAR561 or Co-requisite
PHAR564	Ethics and Communication Skills	3	-	-	PHAR561
PHAR565	Pharmacoeconomics and Pharmacy Administration	3	-	-	PHAR401

PHAR566	Pharmaceutical Marketing *	2	-	-	PHAR565
PHAR567	Toxicology #	2	-	-	PHAR446
PHAR572	Pharmaceutical Law and Regulatory affairs	2	-	-	PHAR565
TOTAL		**94**	**9**	**18**	

2. Mandatory Pharmacy raining: (6) credit hours

Course No.	Course title	Credit hours		Weekly practical hours	Prerequisite or co-requisite
		Theoretical	Practical		
PHAR202	Pharmacy Training 1	-	1	2	PHAR242 or Co-requisite
PHAR401	Pharmacy Training 2 $	-	3	40	Passing 120 credit hours
PHAR569	Pharmacy Training 3	-	2	4	PHAR401
Total		**-**	**6**	**46**	

$: Students are trained for 8 consecutive weeks in a registered community pharmacy inside Jordan. Students are not allowed to have training outside Jordan. Students are not allowed, under any circumstances, to register for courses along with the training. Students are eligible for this training only after passing 120 credit hours.

Study Plan

FIRST YEAR											
First semester						Second semester					
Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite	Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite
		Theoretical	Practical					Theoretical	Practical		
HSS103CHEM	General Chemistry	3	-	-	-	LG103	Life Skills	2	-	-	-
CHEM107	General Chemistry lab	-	1	2	HSS103CHEM (or Co-requisite)	MS100	Military sciences$$	3	-	-	-
HSS103BT	General Biology	3	-	-	-	HSS119	Entrepreneurship and innovation	2	-	-	-
BT107	General Biology Lab	-	1	2	HSS103BT (or Co-requisite)	MED230A	Human Physiology	3	-	-	HSS103BT
HSS110	Social Responsibility	3	-	-	-	PHAR122	Introduction to Pharmacy	1	-	-	HSS103BT
LG101	Communication Skills in English	3	-	-	Passing LG099$	PHAR124	Pharmaceutical Organic Chemistry	3	-	-	HSS103CHEM
ARB101	Arabic Language	3	-	-	-	PHAR126	Pharmaceutical Analytical Chemistry	2	-	-	HSS103CHEM
Total		**15**	**2**	**4**		**Total**		**16**	**-**	**-**	

$: Or scoring 50% or more in the English Language Level Exam.
$$: Non-Jordanian Arabic-speaking students are required to take a substitute for this course.

SECOND YEAR											
First semester						Second semester					
Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite	Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite
		Theoretical	Practical					Theoretical	Practical		
CHEM262	Biochemistry	3	-	-	PHAR124	PHAR224	Medicinal Chemistry 1	3	-	-	CHEM262 and PHAR124
PH311	Biostatistics	2	-	-	PHAR122	PHAR226	Pharmaceutical Sciences Lab	-	1	2	PHAR224 or Co-requisite
MED372	Pathophysiology	3	-	-	MED230A	PHAR242	Pharmacology 1	3	-	-	MED372 and PHAR122
PHAR221	Pharmaceutical Instrumental Analysis	3	-	-	PHAR126	PHAR252	Pharmaceutics 1	3	-	-	PHAR221
PHAR251	Pharmaceutical Microbiology	3	-	-	MED230A	PHAR202	Pharmacy Training 1	-	1	2	PHAR242 or Co-requisite
-	University Elective	3	-	-	-	-	University Elective	3	-	-	-
Total		**17**	**-**	**-**		**Total**		**12**	**2**	**4**	

THIRD YEAR											
First semester						Second semester					
Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite	Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite
		Theoretical	Practical					Theoretical	Practical		
PHAR323	Medicinal Chemistry 2	3	-	-	PHAR224	PHAR324	Medicinal Chemistry 3	3	-	-	PHAR323
PHAR343	Pharmacology 2	3	-	-	PHAR242	PHAR334	Pharmacognosy and Phytochemistry	3	-	-	PHAR323
PHAR345	Pharmacy Practice Lab	-	1	2	PHAR343 or Co-requisite	PHAR344	Pharmacology 3	3	-	-	PHAR251 and PHAR343
PHAR351	Pharmaceutics 2	3	-	-	PHAR252	PHAR354	Pharmaceutics 3	3	-	-	PHAR351
PHAR353	Drug Compounding Lab 1	-	1	2	PHAR351 or Co-requisite	PHAR356	Drug Compounding Lab 2	-	1	2	PHAR354 or Co-requisite
PHAR355	Biopharmaceutics and Pharmacokinetics	3	-	-	PHAR252	PHAR371	Pharmaceutical Biotechnology	3	-	-	PHAR351
-	University Elective	3	-	-	-	PHAR372	Pharmaceutical Microbiology and Biotechnology Lab	-	1	2	PHAR371 or Co-requisite
Total		**15**	**2**	**4**		**Total**		**15**	**2**	**4**	

FOURTH YEAR											
First semester						Second semester					
Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite	Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite
		Theoretical	Practical					Theoretical	Practical		
PHAR433	Phytotherapy	3	-	-	PHAR334	PHAR446	Therapeutics 2	3	-	-	PHAR445
PHAR445	Therapeutics 1	3	-	-	PHAR344	PHAR448	Clinical Cases Lab 2	-	1	2	PHAR446 or Co-requisite
PHAR447	Clinical Cases Lab 1	-	1	2	PHAR445 or Co-requisite	PHAR462	Drug Information and Clinical Literature Evaluation	3	-	-	PHAR445
PHAR451	Pharmaceutical Technology	3	-	-	PHAR354	PHAR464	Public Health and Policy	3	-	-	PHAR461
PHAR461	Immunology and Vaccines	2	-	-	PHAR344	PHAR482	Non-prescription Pharmaceuticals[#]	3	-	-	PHAR463
PHAR463	Clinical Biochemistry	3	-	-	PHAR344	PHAR484	Simulation Pharmacy	-	1	2	PHAR482 or Co-requisite
						PHAR452	Drug Delivery	3	-	-	PHAR451
Total		**14**	**1**	**2**		**Total**		**15**	**2**	**4**	

Summer semester					
Course No.	Course Name	Total credits		Weekly practical hours	Prerequisite
		Theoretical	Practical		
PHAR401	Pharmacy Training 2[$]	-	3	40	Passing 120 credit hours
Total		**-**	**3**	**40**	

$: Students are trained for 8 consecutive weeks (320 practical hours) in a registered community pharmacy inside Jordan. Students are not allowed to have training outside Jordan. Students are not allowed, under any circumstances, to register for courses along with the training. Students are eligible for this training only after passing 120 credit hours.

FIFTH YEAR											
First semester						Second semester					
Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite	Course No.	Course name	Total credits		Weekly practical hours	Prerequisite/ Co-requisite
		Theoretical	Practical					Theoretical	Practical		
PHAR561	Therapeutics 3	3	-	-	PHAR446	PHAR562	Clinical Nutrition	2	-	-	PHAR561
PHAR563	Clinical Cases Lab 3	-	1	2	PHAR561 or Co-requisite	PHAR564	Ethics and Communication Skills	3	-	-	PHAR561
PHAR565	Pharmacoeconomics and Pharmacy Administration	3	-	-	PHAR401	PHAR566	Pharmaceutical Marketing*	2	-	-	PHAR565
PHAR567	Toxicology#	2	-	-	PHAR446	PHAR572	Pharmaceutical Law and Regulatory affairs	2	-	-	PHAR565
PHAR569	Pharmacy Training 3	-	2	4	PHAR401	-	Faculty Elective	3	-	-	-
-	Faculty Elective	3	-	-	-	-	Faculty Elective	3	-	-	-
Total		**14**	**3**	**6**		**Total**		**15**	**-**	**-**	

Course Description

PHAR122: Introduction to Pharmacy (1 credit hour)

A comprehensive introduction to the pharmacy profession including its history and the important role of pharmacists as part of the medical team. Familiarizing students with the process of drug development, regulation, and ethical foundations for the profession. The course discusses the scope of development in the practice of the profession, and the educational and career opportunities available to pharmacists. The course also explains the role and influence of pharmacists in the process of patient care. Moreover, the course discusses the Pharmacy curriculum, its various fields of knowledge, and the training necessary to succeed in the field of pharmacy.

Prerequisite: HSS103BT

PHAR124: Pharmaceutical Organic Chemistry (3 credit hours)

This course is designed to provide students with a foundation in organic chemistry. Topics include an overview of organic functional groups with emphasis on the physicochemical properties of biological importance. Besides, the course covers essential subjects in organic chemistry, including resonance, aromaticity, acidity, basicity, and stereochemistry of organic compounds. Chemistry of aliphatic and aromatic heterocycles will be included throughout the course.

Prerequisite: HSS103CHEM

PHAR126: Pharmaceutical Analytical Chemistry (2 credit hours)

This course will introduce students to fundamental concepts and problem solving related to conventional analytical methods in pharmaceutical applications. Throughout this course, topics relevant to analysis will be covered, including fundamentals of the analytical process, scientific expressions for concentrations of solutions and pharmaceutical calculations, chemical measurements, experimental error, fundamentals of acids and bases, and chemical equilibrium, in addition to acid-base titration. Practical examples of official analytical on pharmacopeias will also be presented.

Prerequisite: HSS103CHEM

PHAR202: Pharmacy Training 1 (1 credit hour)

This is an introductory training course that takes place in the 2nd year of the study. It provides students with the opportunity to observe and practice a variety of professional activities in multiple settings, including hospital, community pharmacy, industry, and institutional simulated labs. The students will gain hands-on inter-professional ethics, patients communication, and activities by early exposure and engagement in regular services. This course prepares students to develop their professional education and skills before advanced training in the following years of study.

Pre- or co-requisite: PHAR242

PHAR221: Pharmaceutical Instrumental Analysis (3 credit hours)

The course provides an introduction to instrumental analysis and its applications in pharmaceutical sciences. The course focuses on spectroscopy and spectral methods of analysis, including Ultraviolet/visible radiation (UV/Visible), Infra-Red (IR), Nuclear Magnetic Resonance (NMR), and Mass Spectrometry (MS). Chromatographic separation techniques like high-performance liquid chromatography (HPLC) and gas chromatography (GC), in addition to their pharmaceutical applications, are also discussed.
Prerequisite: PHAR126

PHAR224: Medicinal Chemistry 1 (3 credit hours)

This course provides an in-depth look at drugs' pharmacokinetics (absorption and metabolism) and pharmacodynamics, as well as the influence of drugs' physicochemical properties on drug action. The concept of rational drug design and computer-aided drug design will be introduced. The course also explains the structure-activity relationships of drugs acting on the central nervous system and the autonomic nervous system.
Prerequisite: CHEM262 and PHAR124

PHAR226: Pharmaceutical Sciences Lab (1 credit hour)

This course is a practicum designed to train students on the qualitative and quantitative aspects of pharmaceutical analysis, such as titration, chromatographic separation, in addition to techniques pertinent to extraction, isolation, synthesis, purification, and identification.
Pre- or co-requisite: PHAR224

PHAR 242 Pharmacology 1 (3 credit hours)

This course is designed to provide students with the basic principles of pharmacology and an introduction to drugs' pharmacokinetics and pharmacodynamics. The course also provides students with the basic pharmacology of drugs acting on the central nervous system, the autonomic nervous system, local anesthetics, and non-steroidal anti-inflammatory drugs.
Prerequisite: MED372and PHAR122

PHAR251: Pharmaceutical Microbiology (3 credit hours)

The course provides the basics of microbiology and its pharmaceutical/medical importance. The course describes the characteristics and classification of various microorganisms, including viruses, bacteria, and fungi. Moreover, it covers the pathogenesis of microorganisms and their spread. In addition, it provides essentials for understanding the relationship between clinically used antibiotics, and their mode of action. The course also explains the mechanisms of bacterial resistance to antimicrobial agents as well as the role of biofilm in resistance and its impact on health. The students will be introduced to various sterilizing processes, disinfectants, antiseptics, preservatives, and their use to control the spread of microorganisms.
Prerequisite: MED230A

PHAR252: Pharmaceutics 1 (3 credit hours)

This course covers several topics in physical pharmacy, including solubility and solutions of electrolytes and nonelectrolytes and basic pharmaceutical calculations. Students will learn about the colligative properties of solutions and the preparation of isotonic and buffer solutions. Comparison between the ideal and real solutions and deviations from Raoult's law will be covered. Additionally, it provides information about factors affecting the solubility of drugs, distribution phenomenon, and drug dissolution. Students will be introduced to the basic solution formulations for oral, ophthalmic, nasal, vaginal, and topical use.
Prerequisite: PHAR221

PHAR323: Medicinal Chemistry 2 (3 credit hours)

The course covers the structure-activity relationships, physicochemical properties, and pharmacological activities of drugs used to treat cardiovascular disease, diabetes, allergy, and ulcer. Opioids, non-steroidal, and steroidal anti-inflammatory drugs will be covered as well. Besides, the concept of rational drug design and strategies applied during the drug development process will be covered via discussing selected case studies.
Prerequisite: PHAR224

PHAR324: Medicinal Chemistry 3 (3 credit hours)

The course covers the structure-activity relationships, physicochemical properties, and pharmacological activities of chemotherapeutic agents used to treat cancer, bacteria, fungi, and viruses. In addition, selected case studies will be discussed to illustrate the concept of the rational drug design and strategies applied during drug development.
Prerequisite: PHAR323

PHAR334: Pharmacognosy and Phytochemistry

This course is an introduction to pharmacognosy and phytochemistry where the students will study different chemical groups such as glycosides, alkaloids, volatile oils, terpenes, and others. In addition, an extensive study of medicinal plants including their scientific names, natural products of each plant group, their existence, parts used and their medical use will be covered. Moreover, methods of isolation, characterization of active herbal compounds, and their biological activities will be discussed.
Prerequisite: PHAR323

PHAR 343: Pharmacology 2 (3 credit hours)

This course is designed to provide students with the basic pharmacology of drugs used in renal and cardiovascular diseases. Additionally, this interactive course introduces the pharmacokinetics and pharmacodynamics of drugs used in respiratory and gastrointestinal diseases. The basic principles of pharmacology covered in the course include the mechanism of drugs' action, receptor signaling, pharmacokinetics, drug interactions, and side effect profiles.
Prerequisite: PHAR242

PHAR 344: Pharmacology 3 (3 credit hours)
This course is designed to provide students with the basic pharmacology of hormones and drugs acting on the endocrine system. The course discusses the pharmacology of chemotherapeutic agents including antibacterial, antimycobacterial, antifungal, antiviral, and antiparasitic drugs. Moreover, the course focuses on the pharmacology of cancer therapeutic agents including cytotoxic agents and pathway targeted therapies.
Prerequisite: PHAR251 and PHAR343

PHAR345: Pharmacy Practice Lab (1 credit hour)
This practice lab is designed to provide students with skills necessary in organizing patient-related data, solving treatment-related problems, and advancing medication safety. The lab setting will acquaint students with the necessary knowledge and prepare them to document recommendations and communicate with healthcare providers and patients. Presentations, lab simulations, role plays, and various interactive activities will be applied to develop students' skills necessary to meet their career goals. Students are expected to report medication errors and maintain a safe healthcare environment.
Pre- or co-requisite: PHAR343

PHAR351: Pharmaceutics 2 (3 credit hours)
This course covers the physical principles that affect the performance of different semisolid dosage forms, such as basics of rheology, phase equilibria and phase rules, and interfacial phenomena of liquid interfaces including adsorption at the solid-liquid and liquid-liquid interfaces. It also provides students with the types, formulation, preparation, stabilization, packaging, and applications of different dosage forms, including colloids, suspensions and emulsions, semisolid preparations (ointments, creams, gels, pastes), aerosols, and rectal and vaginal dosage forms.
Prerequisite: PHAR252

PHAR353: Drug Compounding Lab 1 (1 credit hour)
This course covers the physical principles about the preparation of some pharmaceutical dosage forms, including preparation of buffers and buffer capacity, isotonicity, solubility, and solubility enhancement, rheology, and interfacial phenomena. Students will apply these principles in the preparation and evaluation of oral solutions like elixirs and syrups, optic and nasal solutions, and suspensions. Additionally, sterile, isotonic solutions including ophthalmic and parenteral solutions using a laminar flow cabinet will also be covered.
Prerequisite: PHAR351 or Co-requisite

PHAR354: Pharmaceutics 3 (3 credit hours)
This course familiarizes students with the physical principles that affect the performance of different solid dosage forms such as diffusion, dissolution, chemical kinetics, particle size distribution, and surface area. It also covers the pre-formulation studies such as possible molecular modifications, bulk characterization, solubility, and stability analyses. The course also familiarizes

students with the formulation, manufacturing, and evaluation of tablets and capsules. Formulation of sustained release dosage forms is also covered in this course.
Prerequisite: PHAR351

PHAR355: Biopharmaceutics and Pharmacokinetics (3 credit hours)
This course includes a study of the physicochemical and biological factors involved in the absorption, distribution, and elimination of drugs as well as methods of calculating drug levels in blood and urine after single or multiple dosing by extravascular or intravenous routes. In addition, students will be introduced to the concepts of bioavailability and bioequivalence, the significance of pharmacokinetics in pharmacy practice, different pharmacokinetic models, and the physiological and pharmaceutical factors affecting the availability of drugs.
Prerequisite: PHAR252

PHAR356: Drug Compounding Lab 2 (1 credit hour)
This lab focuses on several areas of interest in the fields of pharmaceutical technology including preparation of different dosage forms such as emulsions, semisolid preparations such as creams and ointments and suppositories, in addition to the compounding of tablets and capsules and evaluation of solid dosage forms in terms of dissolution, drug content, kinetic degradation, and micromeritics.
Prerequisite: PHAR354 or Co-requisite

PHAR371: Pharmaceutical Biotechnology (3 credit hours)
This course is designed to provide students with a comprehensive framework for various aspects of pharmaceutical biotechnology, including production, dosage forms, and regulatory aspects regarding biopharmaceuticals. The course will cover the key concepts relevant to protein therapeutics including molecular biology, production, and analytical procedures, formulation development, and immunogenicity. Additionally, the course will highlight various classes of currently approved protein therapeutics and the ethical and regulatory aspects of their development and registration.
Prerequisite: PHAR351

PHAR372: Pharmaceutical Microbiology and Biotechnology Lab (1 credit hour)
This lab provides students with the necessary training on the methods of culturing, staining, and identifying bacteria. The course covers topics of preparation of bacterial growth media, differentiation and counting of different types of bacteria, characterization of bacterial resistance to antibiotics, and the determination of minimum inhibitory and minimum bactericidal concentrations. Additionally, students will be familiarized with basic molecular biology and biotechnology techniques, such as plasmid and genomic DNA isolation, DNA amplification and separation, protein isolation, and quantification.
Pre- or co-requisite: PHAR371

PHAR401: Pharmacy Training 2 (3 credit hours)

This course provides didactic material and practical training for 8 consecutive weeks regarding the retail setting of community pharmacy practice. It includes dispensing skills and developing patient counseling skills in registered community pharmacies in Jordan, under the supervision of registered pharmacists. Topics in this course cover medications dispensed for the treatment of diseases attributed to major therapeutics systems. Upon completion of this course, students should be knowledgeable about retail pharmacy settings, merchandising, administration, display, and purchasing skills. In addition, students should be able to perform basic dispensing and counseling processes under the supervision of registered community pharmacists.
Prerequisite: Students are eligible for this training only after passing 120 credit hours.

PHAR433: Phytotherapy (3 credit hours)

This course provides basic information on herbal medicine and products, including indications, proper dosing, precautions, contraindications, herb-herb, and herb-drug interactions. Reliable information resources, regulatory status, assessment, quality control, and standardization of herbal products are also included. Selected herbal medicines and dietary supplements acting on the digestive, respiratory, musculoskeletal, central nervous, cardiovascular, urinary, and endocrine systems will be also discussed. Weight loss products, herbal products increasing disease resistance, and immuno-stimulants will be covered as well.
Prerequisite: PHAR334

PHAR445: Therapeutics 1 (3 credit hours)

This course focuses on understanding the recent guidelines of the pharmacotherapy of cardiovascular, renal, endocrine, respiratory, and gastrointestinal systems in relation to the pathophysiological conditions of the patient. The course also emphasizes understanding the rationale behind drug selection by employing students' understanding of patient-specific risk factors, drug pharmacology in relation to the disease-specific intended outcome, and monitoring parameters in designing a comprehensive pharmaceutical care plan encompassing non-pharmacological and pharmacological approaches of therapy, and offer alternative options when needed.
Prerequisite: PHAR344

PHAR446: Therapeutics 2 (3 credit hours)

This course focuses on understanding the recent guidelines of the pharmacotherapy of neurological and psychiatric disorders, infectious diseases, immunological and hematological diseases, and selected malignancies in relation to the pathophysiological conditions of the patient. The course also emphasizes understanding the rationale behind drug selection by employing students' understanding of patient-specific risk factors, drug pharmacology in relation to the disease-specific intended outcome, and monitoring parameters in designing a comprehensive pharmaceutical care plan encompassing non-pharmacological and pharmacological approaches of therapy, and offer alternative options when needed.
Prerequisite: PHAR445

PHAR447: Clinical Cases Lab 1 (1 credit hour)
This course focuses on developing students' skills to identify and prioritize different drug therapy problems, specify therapeutic goals, and develop pharmacological and non-pharmacological treatment plans for different clinical scenarios or real cases of patients suffering from cardiovascular, renal, endocrine, respiratory, and gastrointestinal tract diseases.
Pre- or co-requisite: PHAR445

PHAR448: Clinical Cases Lab 2 (1 credit hour)
This course focuses on developing students' skills to identify and prioritize different drug therapy problems, specify therapeutic goals, and develop pharmacological and non-pharmacological treatment plans for different clinical scenarios or real cases of patients suffering from neurological and psychiatric disorders, infectious diseases, immunological and hematological diseases, and selected malignancies.
Pre- or co-requisite: PHAR446

PHAR451: Pharmaceutical Technology (3 credit hours)
This course covers the technologies relevant to the production of pharmaceuticals and provides the means necessary to solve some manufacturing development issues, with special emphasis on the technologies of sterile parenteral products manufacturing. Students will be introduced to manufacturing unit operations, and key processes such as mixing, milling, drying, compression, and microencapsulation. Additionally, Quality assurance systems relevant to the manufacturing of pharmaceutical products and GMP requirements are also discussed.
Prerequisite: PHAR354

PHAR452: Drug Delivery (3 credit hours)
This course covers the fundamentals and principles of drug delivery and the applications of these fundamentals to develop controlled drug delivery systems. Students will be introduced to the various technologies and strategies used in drug delivery, and the materials and approaches used in the design and fabrication of such delivery systems. Additionally, students will be familiarized with strategies and considerations in the design of different drug delivery systems that will optimize drug delivery to the body from different routes of administration.
Prerequisite: PHAR451

PHAR461: Immunology and Vaccines (2 credit hours)
This course provides students with a broad overview of basic immunology, with deep insights into cellular and molecular details in areas of central importance to this field. The course will consider both innate and adaptive immunity and include the structure and function of key receptors including immunoglobulins, T cell receptors, and innate pattern recognition receptors. The mechanisms of antibody formation and molecular aspects of cellular immunity, including T and B cell interactions and lymphocyte memory formation are emphasized, and connections to modern biomedical sciences are highlighted with their relation to diseases and therapy. These include presentations and discussions of autoimmunity, immunity against major

microbial pathogens (viruses, bacteria, and parasites), transplantation, and tumor immunology. This course also provides an overview of the immune mechanisms believed to be related to vaccine-induced disease protection and vaccine development.
Prerequisite: PHAR 344

PHAR462: Drug Information and Clinical Literature Evaluation (3 credit hours)
This course was designed to increase students' knowledge and skills needed for the provision of drug information with a major emphasis on retrieving drug information from various reliable resources. This course enables students to develop literature searching and evaluating skills in an efficient manner and gain a better understanding of research design, implementation, and conclusion of interventional and observational research as well as the ethical research boundaries. This course can strengthen students' ability to apply health informatics and promote patient-centeredness.
Prerequisite: PHAR445

PHAR463: Clinical Biochemistry (3 credit hours)
This course provides basic information related to biological and metabolic disturbances related to various disease states. The course provides information about biochemical diagnostic procedures that help in evaluating the efficiency of different body organs. Interpretations of biochemistry and the concentration of carbohydrates, lipids, proteins, electrolytes, blood gases, and enzyme activities are also discussed. Clinical cases are presented to help students to interpret laboratory findings.
Prerequisite: PHAR344

PHAR464: Public Health and Policy (3 credit hours)
This course is concerned with introducing students to various resources and information about values, contexts, principles, and frameworks of public health and policy. It also provides an introduction to public health, explores the history of public health, health determinants and measurements, impact of health disparities on race, class, and gender, moral and legal foundations, public health structures, historical trauma, and cultural competence, health and human rights, advocacy and health equity and the formulation and analysis of public health policies. Students learn the importance of public health concepts and issues in daily pharmacy practice, with an emphasis on applying the fundamental issues of public health within pharmacy practice.
Prerequisite: PHAR461

PHAR482: Non-prescription Pharmaceuticals# (3 credit hours)
This course introduces students to the concept of dispensing medications in the pharmacy without medical prescription and self-care. In addition, the course differentiates between cases that require the referral to the physician and those that be treated in the pharmacy using over-the-counter medications and the proper counseling that should be offered to patients.
Prerequisite: PHAR463

PHAR484: Simulation Pharmacy (1 credit hour)
This lab-based course provides the needed training in simulated community and hospital pharmacy settings which provides opportunities for students to integrate basic science and pharmacy practice and apply pharmacy knowledge to case-based scenarios that demonstrate real-life. This course is intended to emphasize students' skills in pharmacy practice such as taking a medication history, creating a patient profile, patient counseling, and therapeutic drug monitoring.
Pre- or co-requisite: PHAR482

PHAR504A: Selected Topics 1 (1 credit hour)
A selected topic in pharmaceutical sciences will be assigned to students to fulfill certain academic requirements.
Prerequisite: Dean's approval

PHAR504B: Selected Topics 2 (2 credit hours)
A selected topic in pharmaceutical sciences will be assigned to students to fulfill certain academic requirements.
Prerequisite: Dean's approval

PHAR521: Introduction to Scientific Research (3 credit hours)
This course provides undergraduate students with an introduction to scientific research. Topics relevant to scientific research will be covered, including literature search, essential software's in research, research ethics, scientific authorship, data management, research misconduct, scientific writing, the publication process, and human participants and animal subjects in research. Moreover, the course will provide undergraduate students with the opportunity to practice academic writing and present scientific topics.
Prerequisite: PHAR462

PHAR522: Drug Design# (3 credit hours)
This course focuses on the concept of rational drug design and development emphasizing the drug-likeness concept, improving pharmacokinetic properties, optimizing drug-target interactions, and drug-target binding thermodynamics and kinetics. The conventional strategies applied in the lead-to-drug optimization process will be discussed utilizing rational drug design literature as case studies.
Prerequisite: PHAR433

PHAR523: Synthetic Medicinal Chemistry (3 credit hours)
This course covers in-depth organic reactions and their synthetic utility in the field of synthetic medicinal chemistry. Total synthesis and retrosynthetic analysis of a selection of pharmaceuticals and natural products will be included in the course.
Prerequisite: PHAR433

PHAR524: Computer-Aided Drug Design# (3 credit hours)
This is an introductory course designed to provide students with the background and a hands-on understanding of different computer-aided drug design techniques, including molecular modeling, molecular simulation, drug-target interactions and visualization, molecular docking, and ADMET predictions that are integral to the process of drug design and development particularly in lead identification and lead optimization, using freely available software.
Prerequisite: PHAR433

PHAR525: Bioanalysis (3 credit hours)
This course covers the principles and analytical techniques used to separate, detect, identify, and quantify biological samples in different settings. These analyses involve the study of molecules such as proteins, peptides, DNA, and drugs.
Prerequisite: PHAR433

PHAR526: Advanced Instrumental Analysis (3 credit hours)
This course builds on students' existing background in pharmaceutical instrumental analysis to develop both theory and practice relating to the latest analytical techniques used in the pharmaceutical industry and research. The course covers the theory, operation, instrumentation, and applications for selected major techniques. Analytical methods covered include separation techniques (chromatography), mass spectrometry, hyphenated chromatography-mass spectrometry techniques, elemental techniques, and other analytical techniques used in pharmaceutical applications.
Prerequisite: PHAR433

PHAR527: Functional Foods and Nutraceuticals (3 credit hours)
This course will outline the concept of functional foods, nutraceuticals, and dietary supplements, including their health benefits, development, and regulation. Moreover, the principles and processes necessary to evaluate their health claims and the potential long-term effects of their usage will be covered.
Prerequisite: PHAR433

PHAR528: Complementary and Alternative Medicine (3 credit hours)
This course provides a foundation of the therapies and evidence-based clinical applications for the major domains of complementary and alternative medicine practices in healthcare such as yoga, meditation, chiropractic, and acupuncture. Other complementary health approaches such as traditional Arab-Islamic medicine, traditional Chinese medicine, Ayurveda, naturopathy, and homeopathy will be covered. Students will learn how to evaluate the safety and effectiveness of the different complementary and alternative medicine practices.
Prerequisite: PHAR433

PHAR529: Drug Discovery from Nature (3 credit hours)
The focus of this course is to highlight the impact of natural products in the drug discovery and development process. Topics related to the different methods approaches, and strategies utilized in discovering new drug leads from nature will be covered, including biochemistry- and molecular biology-based methods. Several unique drugs of natural origin will be highlighted during the course.
Prerequisite: PHAR433

PHAR531: Elemental Analysis of Medicines (3 credit hours)
This course will introduce the students to the various elemental analytical techniques used in pharmaceutical and medical applications. Both qualitative and quantitative techniques will be discussed. Techniques covered in the course include atomic absorption spectroscopy, atomic emission spectroscopy, and inductively coupled plasma mass spectrometry.
Prerequisite: PHAR433

PHAR532: Biosensors (3 credit hours)
This course will focus on biosensing technologies used for pharmaceutical and medical applications. Basic principles behind the operation of different biosensing devices will be covered. In addition, the different applications of biosensors will be discussed highlighting the advantages and limitations of each technique.
Prerequisite: PHAR433

PHAR533: Selected Topics in Pharmaceutical and Biomedical Analysis (3 credit hours)
This course will focus on recent advances and different applications of selected analytical methodologies in the pharmaceutical and biomedical fields. Topics will include a more detailed discussion of fundamental concepts, and the applications of analytical chemistry in various disciplines.
Prerequisite: PHAR433

PHAR534: Medical Laboratory Testing (3 credit hours)
This course is an introduction to the basic theory and diagnostic procedures used in medical laboratory testing. Fundamentals of biochemical and analytical tests and procedures used in the analysis of clinical specimens will be covered. Topics to be covered include blood, urine, and body fluid analysis, in addition to specimen processing, interpretation of test results, and quality control of data.
Prerequisite: PHAR463

PHAR535: Poisonous Plants (3 credit hours)
This course provides students with an opportunity to study several aspects related to many important poisonous, hallucinogenic, and narcotic plants. Topics include identifying poisonous plants, poisonous compounds, mechanisms of toxicity, clinical signs of poisoning, treatment, and prevention.
Prerequisite: PHAR433

PHAR551: Nanotechnology (3 credit hours)
This course gives the students basic knowledge about nanotechnology and its applications in the medical field. It covers the definition, history, characterization, methods of preparation, and the major types of nanoparticles used in nanomedicine. Additionally, the course provides an overview of the drug delivery systems based on nanotechnology for the delivery of small molecules, proteins, peptides, oligonucleotides, and genes. Additionally, nanoparticulate systems used as antimicrobials, for diagnosis and treatment of cancer, to treat infections, and for wound-healing are also reviewed, along with the toxicity, safety, as well as environmental concerns related to nanoparticles used in the medical field.
Prerequisite: PHAR451

PHAR552: Advanced Pharmaceutical Biotechnology (3 credit hours)
The course provides a detailed perspective on recent approaches used to examine genomes and gene functions, ranging from classical genetics to the new high-throughput techniques. Attention is given to the genomic characterization of simple and complex species. Various sequencing approaches and interpretative approaches using functional and comparative genomics are discussed. Transcriptomics (study gene expression) and Proteomics (separate and identify proteins) methods are also included. Additionally, students are introduced to the cloning basics and general Bioethical and regulatory issues.
Prerequisite: PHAR452

PHAR553: Advanced Pharmaceutical Microbiology (3 credit hours)
This course is designed to introduce students to advanced topics in pharmaceutical Microbiology which have high relevance to pharmacy in all its aspects. It covers the manufacture and quality control of pharmaceutical products, sterilization, disinfection, microbiological contamination of sterile and non-sterile pharmaceutical products, along with understanding bacterial resistance and the mode of action of antimicrobial agents and their clinical use against pathogenic bacteria, fungi, parasite, and viruses. Additionally, it familiarizes students with the various characters of bacterial biofilms in relation to their structure, pathogenicity, Diseases, and their resistance towards antimicrobial agents.
Prerequisite: PHAR452

PHAR554: Gene Therapy# (3 credit hours)
This course is designed to provide students with a comprehensive understanding of the rationale and the applications of gene therapies, with special emphasis on current technologies essential for their clinical use, such as molecular cloning techniques, production and formulation, delivery into target cells and tissues, and the challenges related to the use of biologics as drugs. The

students will gain broad comprehension of designing treatment strategies for various diseases using gene drugs, the rationale of their use, and their mechanism of action. Additionally, the course will provide a broad comprehension of regulatory and ethical issues related to strategies, techniques, and the use of gene drugs as modern biomedical practice tools.
Prerequisite: PHAR452

PHAR555: Cosmetic Preparations (3 credit hours)
This course covers the basic pharmaceutical aspects regarding hair and skincare products, raw materials and formulation considerations, and the counseling essentials on the proper use of these products. Topics include hair growth and morphology, straightening, depilation, coloring, and bleaching of hair, in addition to surfactants, shampoos, and conditioners. Additionally, it covers topics related to the anatomy and disorders of the skin, sunscreens, bleaching agents, antiaging products, and skin moisturizers. Students will also get knowledge on different types of soaps and their ingredients and basics of soap pharmaceutics.
Prerequisite: PHAR451

PHAR 556: Stem Cell Therapy and Regenerative Medicine (3 credit hours)
This course is designed to provide students with the knowledge and understanding of the field of stem cells and their applications in modern pharmaceutical and biomedical fields. Students will be introduced to the key concepts in stem cell biology and differentiation, methodologies and tools for tissue and organ engineering and regeneration, cell reprogramming and gene editing, bioprocessing, and drug discovery. Significant emphasis will be on the promising therapeutic potential and the limitations of stem cell therapy, particularly the ethical considerations of stem cell technologies.
Prerequisite: PHAR452

PHAR557: Advanced Industrial Pharmacy (3 credit hours)
This course covers the technical, administrative, and regulatory aspects of the pharmaceutical industry with various guidelines, and quality systems. It is designed to familiarize the student with the manufacturing of various pharmaceutical dosage forms along with patent knowledge, material management, and various analytical techniques required to evaluate dosage forms. Additionally, it provides a comprehensive knowledge of engineering services and warehousing systems of pharmaceutical plants.
Prerequisite: PHAR452

PHAR558: Advanced Industrial Pharmacy (3 credit hours)
This course provides an overview of the biological basis for the development and evaluation of new viral, bacteriologic, parasitic, and cancer vaccines. It covers the recent genomic and proteomic technologies for identification, validation, and evaluation of vaccine antigens, and the novel adjuvant to enhance vaccination efficacy. Additionally, it familiarizes students with the antigen-carrier systems and formulation strategies to enhance the delivery and presentation of specific immunogens to effector sites.
Prerequisite: PHAR452

PHAR559: Advanced Pharmacokinetics (3 credit hours)
This course will emphasize pharmacodynamics models and special populations that have modified body physiology which can result in different drug pharmacokinetics as compared to the healthy adult population. Among these populations are patients with cancer, patients with renal impairment, patients with hepatic impairment, premature infants, geriatrics, and pregnant females. A full understanding of changes in the body physiology and biochemistry in these populations and the expected effects of these changes on drug pharmacokinetics and the possibility for dose adjustments will be discussed.
Prerequisite: PHAR452

PHAR561: Therapeutics 3 (3 credit hours)
This course focuses on understanding the recent guidelines of the pharmacotherapy of pediatric and geriatric diseases, gynecological and obstetrics disorders, urological disorders, and bone and joints disorders in relation to the pathophysiological conditions of the patient. The course also emphasizes understanding the rationale behind drug selection by employing students' understanding of patient-specific risk factors, drug pharmacology concerning the disease-specific intended outcome, and monitoring parameters in designing a comprehensive pharmaceutical care plan encompassing non-pharmacological and pharmacological approaches of therapy, and to offer alternative options when needed.
Prerequisite: PHAR446

PHAR562: Clinical Nutrition (2 credit hours)
The course presents an overview of the biological basis of human nutrition and the role of nutrients in promoting health. This course also focuses on the special needs of people throughout the life in health and disease in addition to nutrition therapy of selected diseases such as upper and lowers gastrointestinal diseases, diabetes mellitus, and cardiovascular diseases.
Prerequisite: PHAR561

PHAR563: Clinical Cases Lab 3 (1 credit hour)
This course focuses on developing students' skills to identify and prioritize different drug therapy problems, specify therapeutic goals, and develop pharmacological and non-pharmacological treatment plans for different clinical scenarios or real cases in pediatrics, geriatrics, and patients suffering from gynecological & obstetrics, urological, bone, and joint disorders.
Pre- or co-requisite: PHAR561

PHAR564: Ethics and Communication Skills (3 credit hours)
This course discusses moral-ethical concepts and key concepts related to patients' rights, confidentiality, and care in pharmacy practice. Further, verbal, and non-verbal communication skills to prepare students for the pharmacy profession are the major focus of this course. Overall, this course focuses on principles, practices, and procedures necessary to establish a climate that fosters healthcare provider-patient interactions and enhances students' ability to promote positive health outcomes and patient wellbeing.
Prerequisite: PHAR561

PHAR565: Pharmacoeconomics and Pharmacy Administration (3 credit hours)
This course covers basic principles of pharmaceutical economics. This course supports the students' development of competencies in healthcare decision-making through the understanding and assessment of economic, clinical, and humanistic outcomes. It covers the application of economic-based evaluation methods for pharmaceutical products and services (e.g., Cost-Effectiveness Analysis and Cost-Utility Analysis). In addition, this course aims to provide students with knowledge and skills regarding the roles of management in pharmacy practice focusing on personal management, operations management, managing people, and managing risks.
Prerequisite: PHAR401

PHAR566: Pharmaceutical Marketing* (2 credit hours)
The course covers marketing fundamentals required to understand marketing ideas and techniques to promote new products, develop innovative services, and generate business within the scope of pharmacy. The course is designed to teach students detailing in pharmaceutical marketing and to help students to better deal with an increasingly complex market environment. Also, the course teaches pharmacy students how to design a full marketing plan for a new medication or pharmaceutical product.
Prerequisite: PHAR565

PHAR567: Toxicology# (2 credit hours)
The course studies the body's response to drugs, foods, and toxic substances. This course includes a comprehensive discussion of the principles of toxicokinetics and toxicodynamics derived from environmental, dietary, occupational, and pharmaceutical sources, first aid, common antidotes, and skills to deal with poisoning by drug and medical products. The course is a project-based course that provides the chance for students to work in teams, search and present awareness of selected toxic substances to their surrounding community. (This is a project-based course).
Prerequisite: PHAR446

PHAR569: Pharmacy Training 3 (2 credit hours)
Clinical pharmacy training in various hospital departments. This includes various activities such as attending morning rounds, other clinical rounds, and discussing clinical cases based on daily follow-up and monitoring, and detailed evaluation of the pharmacotherapeutics of their assigned patients in the departments. The goal is to improve students' practical clinical skills that would enhance the positive contribution of clinical pharmacists in medical care at the hospital.
Prerequisite: PHAR401

PHAR572: Pharmaceutical Law and Regulatory affairs (2 credit hours)
This course introduces pharmacy laws that govern pharmacy practice in Jordan and the professional roles of pharmacists in medical and pharmaceutical institutions. In addition, it covers pharmaceutical industry regulations, good pharmaceutical industry practices principles, ethical considerations, regulatory dossier sections preparation, and licensure. Students will be

introduced to the vital role performed by regulatory professionals in pharmacy and become familiar with domestic regulatory requirements in Jordan and various regulatory agencies in other countries and their jurisdiction.
Prerequisite: PHAR565

PHAR586: Targeted Cancer Therapies (3 credit hours)
This course provides an in-depth understanding of the molecular basics for the development and therapeutic use of targeted anticancer drugs. The course provides an overview of the basic concepts of signal transduction and cell signaling responsible for cancer cell growth and proliferation. The course will also explain the intricate signaling pathways between cancer cells and the tumor microenvironment. A major emphasis will be given to discuss several classes of targeted anticancer drugs used in the treatment of different neoplastic disorders that represent excellent examples of personalized medicine. These drug classes include monoclonal antibodies, small-molecule kinase inhibitors, immune checkpoint inhibitors, signal transduction inhibitors, and apoptosis inducers. These drug classes will be discussed in terms of their development, pharmacodynamics, therapeutic indications, and the emergence and mechanisms of cancer resistance.
Prerequisite: PHAR344

PHAR587: Drug Development: Introduction to Clinical Trials (3 credit hours)
This course is designed to introduce the lifecycle approach to drug development from early discovery to conducting clinical trials. It will describe the new drug development, drug discovery, non-clinical research, the design, and conduct of clinical trials. It will cover topics like different clinical trial designs, study conduct, clinical significance, sample size estimation, general safety assessments, efficacy assessments, and post-marketing studies.
Prerequisite: PHAR344

PHAR588: Advanced Therapeutics (3 credit hours)
This course discusses the therapeutics for some clinical cases and selected drugs in a comprehensive and detailed manner. The course focuses on understanding and applying the most recent guidelines to the development of optimum and comprehensive pharmaceutical care plan encompassing non-pharmacological and pharmacological approaches of therapy, and offers alternative options when needed.
Prerequisite: PHAR561

PHAR590: Advanced Pharmacology (3 credit hours)
This course introduces the recently advanced principles of pharmacology and an in-depth assessment of selected groups of drugs. Moreover, the current course provides specific emphasis on the sites and mechanisms of drug action, indications, contraindications, adverse effects, and drug-drug interactions. The course reviews signal transduction pathways and provides a detailed discussion of the molecular pharmacology of receptors, channels, and enzymes.
Prerequisite: PHAR344

PHAR591: Advanced Pharmacy Practice* (3 credit hours)

This course is designed to assist students in utilizing knowledge, experience, and critical thinking to appropriately ensure effective and safe therapeutic options and achieve greater success in the advanced-pharmacy practice. Students will be engaged with active-learning activities such as drug-utilization reviews (DURs), blood pressure measuring, blood glucose testing, patient counseling, mocking scenarios revolve around drug-drug interactions, and filling prescriptions throughout this course to enhance their clinical competence. The course will help acquire the skill sets necessary to emphasize the emerging roles of clinical pharmacy that have the potential to improve the quality of healthcare services and contribute to cost savings.

Prerequisite: *PHAR401*

PHAR592: Pharmacoepidemiology* (3 credit hours)

This course addresses a range of study designs and analytic techniques for observational studies on the utilization, safety, and effectiveness of pharmaceuticals. Students will develop an understanding of how to plan, implement, analyze, and criticize pharmacoepidemiologic studies. Lectures will provide methodological background and will cover applied issues typically encountered in Pharmacoepidemiology.

Prerequisite: PHAR462

PHAR593: Molecular Pharmacology (3 credit hours)

This course introduces the essential principles of molecular pharmacology. It also covers the types of receptors, second messengers, and cellular mechanisms of drug actions. This course discusses the structures of genes and nucleic acids, replication, translation, and the control of these processes as sites of drug action.

Prerequisite: PHAR344

PHAR595: Pharmacogenetics (3 credit hours)

This course will discuss how an individual's genetic inheritance affects the body's response to drugs. This course examines factors that affect drug response including genetics, as well as, additional factors such as environment, diet, age, and concurrent drug therapy, and health status. The course aims to provide students with an understanding of pharmacogenetics in the context of variability in drug response and the application of pharmacogenetics to drug development and treatment.

Prerequisite: PHAR344

PHAR596: Hospital Pharmacy (3 credit hours)

This course provides the students with an in-depth understanding of institutional pharmacy practice. As it covers a detailed introduction of the practice of pharmacy in hospitals, including both professional and administrative activities. These activities include the organization of the hospital pharmacy, management of people, use of technology, purchase and inventory control, the pharmacy and therapeutic committee, the hospital formulary, unit dose system, preparation of intravenous admixture services, medication safety, and how to conduct patient education and counseling.

Prerequisite: PHAR401

PHAR597: Clinical **Pharmacology (3 credit hours)**
This course covers the essential principles of clinical pharmacology, clinical uses, adverse effects, precautions, drug interactions, and contraindications for selected groups of drugs. The course will review different features dealing with drug monitoring, reasons behind adverse effects development, and common aspects in clinical toxicology. Moreover, this course explains the rationale for using certain drugs in clinical practice to treat pathological diseases based on the drugs' mechanism of action.
Prerequisite: PHAR344

PHAR598: **Pharmacy Management and Accounting (3 credit hours)**
This course deals with managerial aspects relevant to pharmaceutical organizations such as strategic planning, finance, accounting and technology, and information systems. The course familiarizes the students with financial reports, third-party payers' considerations, budgeting, and personal finance. In addition, this course informs students about management applications in specific pharmacy practice settings.
Prerequisite: PHAR484

PHAR599: **Public Health Toxicology (3 credit hours)**
Students examine basic concepts of toxicology as they apply to the effects of environmental agents, e.g. chemicals, metals, on public health. The course discusses the distribution, cellular penetration, metabolic conversion, and elimination of toxic agents, as well as the fundamental laws governing the interaction of foreign chemicals with biological systems. Students will be oriented on the application of these concepts to the understanding and prevention of morbidity and mortality resulting from environmental exposures to toxic substances through case study presentations.
Prerequisite: PHAR567