



Jordan University of Science and Technology
Faculty of Graduate Studies



**Course Curriculum for Master Degree in Medicinal Chemistry
and Pharmacognosy/Medicinal Chemistry (2017)**

The Master Degree in Medicinal Chemistry and Pharmacognosy/Medicinal Chemistry is awarded by the Faculty of Graduate Studies at Jordan University of Science and Technology (JUST) upon the fulfillment of the following requirements:

1. Compliance with the JUST Master Degree regulations approved by the Dean Council (No. 25-2017), dated 19-6-2017.
2. Successful completion of (34) credit hours.

1. Compulsory Requirements: (16) credit hours as follows:

Course Code	Course Name	Credit Hours
PHAR 709	Seminar	1
PHAR 720	Research Methodology	3
PHAR 721	Advanced Pharmaceutical Organic Chemistry	3
PHAR 722	Organic Structure Determination	3
PHAR 723	Stereochemistry	2
PHAR 726	Analytical Techniques in Drug Discovery	2
PHAR 727	Organic Synthesis Research Laboratory	2

2. Elective Requirements: (9) credit hours as follows*:

Course Code	Course Name	Credit Hours
PHAR 724	Advanced Physical Organic Chemistry	3
PHAR 725	Synthetic Medicinal Chemistry	3
PHAR 731	Drug Discovery from Nature	3
PHAR 732	Biosynthesis	3
PHAR 735	Chromatography	3
PHAR 779A	Special Topics A	2
PHAR 779B	Special Topics B	1
PHAR 780	Selected Topics in Medicinal Chemistry	2
PHAR 781	Molecular Modeling and Computer-Aided Drug Design	3
PHAR 782	Advanced Drug Design	3
PHAR 783	Bioinformatics and Drug Discovery	2
PHAR 785	Enzymes and Drug Action	3

* The student may study not more than 3 credit hours from courses of (700 or 800) level offered by other programs related to his field of study upon approval of the Dean based on the departmental committee recommendation and the approval of the faculty committee of graduate studies.

3. Master Thesis (PHAR 799): Total of (9) credit hours as follows:

Course Code	Course Name	Credit Hours
PHAR 799A	Master Thesis	9
PHAR 799B	Master Thesis	6
PHAR 799C	Master Thesis	3
PHAR 799D	Master Thesis	0



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and Pharmacognosy/Pharmacognosy**

The Master Degree in Medicinal Chemistry and Pharmacognosy/Pharmacognosy is awarded by the Faculty of Graduate Studies at Jordan University of Science and Technology (JUST) upon the fulfillment of the following requirements:

3. Compliance with the JUST Master Degree regulations approved by the Dean Council (No. 492/2006), dated 8/8/2006.
4. Successful completion of (34) credit hours.

1. Compulsory Requirements: (16) credit hours as follows:

Course Code	Course Name	Credit Hours
PHAR 709	Seminar	1
PHAR 720	Research Methodology	3
PHAR 721	Advanced Pharmaceutical Organic Chemistry	3
PHAR 722	Organic Structure Determination	3
PHAR 723	Stereochemistry	2
PHAR 726	Analytical Techniques in Drug Discovery	2
PHAR 734	Natural Products Research Laboratory	2

2. Elective Requirements: (9) credit hours as follows*:

Course Code	Course Name	Credit Hours
PHAR 725	Synthetic Medicinal Chemistry	3
PHAR 730	Selected Topics in Natural Products Chemistry	2
PHAR 731	Drug Discovery from Nature	3
PHAR 732	Biosynthesis	3
PHAR 733	Taxonomy in Drug Discovery from Nature	2
PHAR 735	Chromatography	3
PHAR 779A	Special Topics A	2
PHAR 779B	Special Topics B	1
PHAR 781	Molecular Modeling and Computer-Aided Drug Design	3
PHAR 782	Advanced Drug Design	3
PHAR 783	Bioinformatics and Drug Discovery	2
PHAR 784	Phytopharmaceuticals	2
PHAR 785	Enzymes and Drug Action	3

* The student may study not more than 3 credit hours from courses of (700 or 800) level offered by other programs related to his field of study upon approval of the Dean based on the departmental committee recommendation and the approval of the faculty committee of graduate studies.

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PHAR 799D	Master Thesis	0

Course Descriptions

PHAR 709 Seminar (1 Credit Hour):

This course provides new graduate students the opportunity to practice speaking in front of audiences by presenting scientific topics. Topics related to seminar preparation and presentation will be covered.

PHAR 720 Research Methodology (3 Credit Hours):

This course provides new graduate students with a foundation to begin research in the fields of Medicinal Chemistry and Pharmacognosy. Topics relevant to graduate studies and research will be covered, including literature search, research ethics, scientific authorship, data management, research misconduct, scientific writing, human participants and animal subjects in research, and laboratory safety. Moreover, the basics of biostatistics pertinent to data collection, analysis, and presentation will be covered.

PHAR 721 Advanced Pharmaceutical Organic Chemistry (3 Credit Hours):

The aim of this course is to provide students with advanced knowledge of numerous aspects of organic chemistry, as it applies to modern medicinal chemistry. Topics include types and classification of reaction mechanisms with emphasis on some related reactions. Furthermore, the course covers various chemical reactions involving enolates and other carbon nucleophiles, organometallic compounds of group I and II metals as well as transition metals. The course also covers the fundamentals of heterocyclic compounds including properties, synthesis and reactions of aliphatic and aromatic heterocycles with emphasis on five-membered, six-membered, and fused heterocycles

PHAR 722 Organic Structure Determination (3 Credit Hours):

The major focus of this course is organic structure determination via spectra. Concepts and applications of modern and advanced spectroscopic and spectrometric techniques in structural elucidation of organic compounds, including nuclear magnetic resonance spectroscopy (FT-NMR), mass spectrometry (MS), UV-Visible spectroscopy (UV-vis), and Infrared spectroscopy (FT-IR). The physical and chemical principles of each method will be discussed.

PHAR 723 Stereochemistry (2 Credit Hours):

This course covers the stereochemistry of organic compounds; chirality; resolution and analysis of enantiomers and diastereomers, conformational isomerism and geometrical isomerism. Introduction to stereoselective synthesis and drug design will be given. In addition, stereoselectivity in nature and spectroscopic determination of relative and absolute chirality will be discussed.

PHAR 724 Advanced Physical Organic Chemistry (3 Credit Hours):

This course covers advanced topics in chemical structures and bonding, mechanism of important classes of chemical reaction, reaction kinetics, acids and bases and aromaticity. Great emphasis will be on the experimental evidence for chemical behavior of organic compounds.

PHAR 725 Synthetic Medicinal Chemistry (3 Credit Hours):

The aim of this course is to provide students with advanced knowledge of numerous aspects of synthetic organic chemistry, as it applies to modern medicinal chemistry. The course includes readings in and critical analysis of recent literature in synthetic and medicinal chemistry research. The course covers total synthesis and retrosynthetic analysis and strategies of a selection of natural products and pharmaceuticals. An understanding of reaction mechanisms will be emphasized throughout.

PHAR 727 Organic Synthesis Research Laboratory (2 Credit Hours):

Practical organic chemistry course that aims to teach students the necessary skills of synthesis, purification, and systematic identification of organic compounds based on their physical, chemical, and spectral properties using namely NMR and IR spectra. The techniques of separating organic mixtures using column chromatography, flash chromatography, and HPLC will also be covered.

PHAR 726 Analytical Techniques in Drug Discovery (2 Credit Hours):

This course will introduce the student to analytical process and various analytical techniques used for pharmaceutical and drug discovery applications. The application of three key types of analysis: separation, identification and quantification, and process of selection of a valid

method of analysis will be described. Spectroscopic techniques and their applications involving absorption, fluorescence, luminescence and emission will be discussed. Basic knowledge of separation techniques such as HPLC, GC and electrophoresis will be also covered. The course will also introduce the student to various techniques used in bioanalysis

PHAR 730 Selected Topics in Natural Products Chemistry (2 Credit Hours)

This course is designed to cover the up-to-date aspects of natural products chemistry.

PHAR 732 Biosynthesis (3 Credit Hours):

This course deals with natural products from a biosynthetic perspective. Emphasis will be on biosynthetic techniques, mechanism, and pathways leading to the major natural products classes. Enzyme chemistry will also be studied.

PHAR 733 Taxonomy in Drug Discovery from Nature (2 Credit Hours):

This course covers the identification and classification of medicinal plants and microorganisms as potential sources of new drugs using both conventional and modern taxonomic methodologies. Topics related to samples' collection and handling will be covered as well.

PHAR 735 Chromatography (3 Credit Hours):

The objective of this course is to familiarise the student with the theory and practice of the state of the art of analytical and preparative chromatographic separation processes. Topics include: Theory of chromatography, chromatographic techniques and LC method selection and development (e.g. choice of sample preparation, columns, mobile phase and detector). An emphasis on development and optimising chromatographic methods coupled to MS will be made. Tutorials, critical reviews of the current literature and laboratory demonstrations in the lab will be employed throughout the course to illustrate important concepts and familiarise students with instrumentation.

PHAR 734 Natural Products Research Laboratory (2 Credit Hours):

This course covers special techniques of certain importance in natural product research such as extraction procedures, open column chromatography, flash chromatography, thin layer chromatography (TLC), analytical and preparative HPLC, GC, GC/MS and LC/MS.

PHAR 779A Special Topics A: (2 Credit Hours)

Special topics in advanced pharmaceutical sciences are discussed.

PHAR 779B Special Topics B: (1 Credit Hour)

Special topics in advanced pharmaceutical sciences are discussed.

PHAR 780 Selected Topics in Medicinal Chemistry (2 Credit Hours)

This course is designed to cover the up-to-date aspects of medicinal chemistry.

PHAR 782 Advanced Drug Design (3 Credit Hours):

The course discusses the concept of rational drug design and the conventional strategies applied in lead-to-drug optimization process. The course focuses on mastering the ability of students to critically analyze drug design literatures and solving problems encountered during lead-to-drug optimization process.

PHAR 785 Enzymes and Drug Action (3 Credit Hours):

This course covers subjects related to mechanisms of enzyme inhibition such as transition state analogs, noncompetitive enzyme inhibition, and irreversible mechanism-based inhibition. Besides, there will be a coverage of enzyme kinetics and their application in enzyme inhibition. Moreover, there will be a study of drug metabolic processes. Phases, reactions, and reaction mechanisms of metabolic pathways will be discussed in details. In addition, factors affecting drug metabolism, drug-metabolizing enzyme systems, and drug metabolism in drug design will be discussed.

PHAR 781 Molecular Modeling and Computer-Aided Drug Design (3 Credit Hours):

This course covers the theory of molecular modeling, including force fields, energy minimization, molecular dynamics, homology modelling and their applications in drug design. In addition, it covers theory and practice of most currently used computational techniques in the field of computer-aided drug design, including approaches for both ligand and target drug design such as similarity searching, pharmacophore modeling, QSAR, docking and scoring, virtual screening, and ADMET property prediction.

PHAR 783 Bioinformatics and Drug Discovery (2 Credit Hours):

This course focus on the use of bioinformatics on drug discovery. Topics related to genomics, transcriptomics, proteomics, population genetics, and molecular phylogenetics will be covered.

PHAR 784 Phytopharmaceuticals (2 Credit Hours):

This course deals with drugs whose active constituents are exclusively plant-based and are used in rational phytotherapy. Topics related to the evaluation of their quality and assessment of their safety and efficacy will be covered.

PHAR 731 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 the discovery of new drug leads from nature will be covered, including biochemistry- and molecular biology-based methods. A number of unique drugs of natural origin will be highlighted during the course.

PHAR 799 Master Thesis: (9 Credit Hours)

Individual research under the direction of a faculty member (s) and committee leading to preparation, completion, and oral defense of a thesis.