Faculty of Pharmacy and Drug Manufacturing

Pharos University in Alexandria



Program Specification

Master's Degree in Pharmaceutical Sciences (Pharmaceutical Chemistry)

إعتماد مجلس وحدة 10/8/2020

إعتماد مجلس كلية 12/8/2020

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Faculty of Pharmacy and Drug Manufacturing



جامعة فراروس بالإسكندرية حلية الصيدلة والتصنيع الدوائي

University: Pharos University in Alexandria. Faculty: Pharmacy and Drug Manufacturing

Program Specification

A- Basic Information:

1- Program Title: Master's Degree in Pharmaceutical Sciences (Pharmaceutical Chemistry)

2- Program Type:	Single 🖌	Double	Multiple
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3- Department (s): Pharmaceutical Chemistry

4- Program Coordinator: Prof. Dr. Soad Toaima

5- Date of program specifications approval 12/8/2020

B- Special Information:

1- Program Aims:

The program aims to cover up all the essential basis and principles underpinning research in Pharmaceutical Chemistry. It provides the researcher fundamental background in instrumental analysis, QA/QC components, chemical reactions mechanism, stability study of new drug substance and product, various analytical techniques for drug discovery. It aims to give a detailed knowledge about formulation chemistry and drug design. Generally, it offers the specialist a conceptual and intellectual foundation for further studies in pharmaceutical chemistry.

Graduate Attributes:

- 1. Demonstrate an up-to-date knowledge and understanding of general pharmaceutical sciences including physical chemistry, instrumental analysis, statistics & biostatistics as well as specialized pharmaceutical analytical sciences including advanced spectroscopic, chromatographic, electrochemical methods of analysis
- 2. Demonstrate knowledge and practical research skills of quality control of pharmaceutical products and validation of analytical methods
- 3. Apply appropriate analytical techniques in evaluating dosage forms, based on principles of analytical methodology in light of regional and international changes and employ available resources of chemicals and instruments to the greatest benefits.
- 4. Recognize multidisciplinary and progressive knowledge of key chemical concepts in the field of medicinal and pharmaceutical chemistry, underlying biological processes, aspects of medicinal sciences complementary to





chemistry, knowledge necessary for the study of pharmaceutical products and awareness of advances at the forefront of the chemical science discipline.

- 5. Apply principles and methodologies involved in the production of new drugs.
- 6. Learn statistical methods necessary for deriving correct conclusions from generated experimental data and promote self-development and apply continuous self-education
- 7. Examine scientific evidence both quantitative and qualitative to arrive at evidence-based conclusions.
- 8. Critically analyze relevant published information.
- 9. Present experimental results for peer-evaluation and publication through written reports, thesis, journal articles and/or presentations at conferences.
- 10. Apply ethics of scientific research and information technology in different professional settings.
- 11. Demonstrate competency in professional and research skills set upon graduation (above average of those of other Egyptian universities).
- 12. Obtain self-learning ability needed for continuing professional development
- 13. Obtain skills of effective communication, teamwork, leadership, critical thinking, decision making, and problem solving.

2- Intended Learning Outcomes (ILOs):

2/1- Knowledge and Understanding:

A1: Define the basic rules and principles of physical chemistry (States of matter, buffers, Law of thermodynamics, Kinetics terminology).

A2: Recall rules needed for the calculations to solve problems in different areas of analytical chemistry.

A3: Describe nanostructures as well as the basic principles of UV, Visible, fluorescence spectroscopy and different types of chromatographic, spectroscopic and electrochemical techniques used in drug analysis

A4: Identify quality assurance (QA), quality control (QC), good analytical practice (GAP), good laboratory practice (GLP), good quality management (GQM) and biostatistics and its applications method development, validation and in sampling and sample preparation ready for analysis.

A5: Recognize basic principles and major synthetic pathways in Organic Chemistry and medicinal chemistry, involving tautomerism, organic reactions energetics and kinetics, and acidity and basicity, and approach the pharmacokinetic and pharmacodynamics studies of drugs inside the body.

A6: Outline factors affecting chemical stability of drugs and structural elucidation of the degradation products using different techniques.

A7: Illustrate the ability of using drug information resources and the internet to acquire chemistry knowledge.



A8: Describe the processes involved in gene organization, replication, expression, recombinant DNA biotechniques and the mechanisms of different molecular biology techniques used in diagnosis of genetic diseases.

A9: Identify the etiology, treatment, prevention and appropriate treatment for the various diseases causing alterations in body function.

A10: Explain the fundamental principles of pharmacology and cell signaling pathways to detect possible targets for drug action, molecular basis of different receptor types and how they can be modulated by different pharmacological agents.

A11: Identify principles and applications of biostatistics.

A12: Recognize bioinformatics software and web-based applications; that are required to search for, analyze and submit molecular biology and gene technology data to learn how to access new information in pharmaceutical research and development of new drugs.

A13: Demonstrate expertise in highly specialized and advanced research by the design, execution, and preparation of written and oral reports based on research investigation.

2/2- Intellectual Skills:

- B1: Distinguish between the different orders of reactions and the calculations of the half-life time of drugs.
- B2: Explain the interaction between electromagnetic radiation and matter on atomic and molecular levels.
- B3: Apply validation concept whenever needed
- B4: Criticize published evidence-based information and problem solving of relevance to Organic, Analytical and Medicinal Chemistry by the aid of computer technology.
- B5: Select the proper different HPLC conditions for separation and quantification
- B6: Evaluate information data from a variety of sources to plan different work strategies.
- B7: Select the most appropriate conditions for storing and distributing different pharmaceutical products and the appropriate method of analysis for appropriate interpretation of data.
- B8: Explain how structural and molecular biology, and modern enzymology have revolutionized the understanding of selective drug action and development of new therapies.
- B9: Examine basic techniques of proteins, DNA & RNA extraction, separation and quantification.
- B10: Analyze information in different fields of pharmacology and basic principles of cell signaling pathways to detect possible targets for drug action, molecular basis of different receptor types for their modulation by different pharmacological agents.
- B11: Analyze different data about drug groups used for certain pathology to choose the proper agent used in a certain patient e.g. with other comorbidity.



B12: Detect the scope of computational biology and bioinformatics software and webbased applications to analyze molecular biology and gene technology data for pharmaceutical research and drug design.

B13: Discover the properties of nanostructures, their manufacturing and applications

2/3- Professional and Practical skills:

C1: Develop proper chemical formulas of different chemical compounds and skills of using calculations in different tasks.

C2: Apply spectrophotometry in qualitative and quantitative determination of drugs, as well as advanced analytical methods and operating related instruments in laboratory.

C3: Classify pharmacopoeial qualification, calibration & standardization and parameters for working safely in laboratory.

C4: Discuss physical and chemical properties or changes taking place in a drug.

C5: Develop the correct reporting of spectrophotometric and different analytical data as used in pharmaceutical analysis.

C6: Design strategy of original research including writing a scientific report and reading papers concerning these issues with the aid of new computer technologies.

C7: Evaluate standard methods for quantitative analysis of concentration-time profile

C8: Create comments on reports for situations related to the field of pharmacy including critical reviews of scientific articles and peer evaluation.

C9: Compile reviews and essays discussion competently for effective information management.

C10: Develop independent and self-critical learning ability by solving disease related cases.

C11: Develop research skills including knowledge of general principles and procedures of research methodology and experimental design in the fields of pharmacy

C12: Develop competence, confidence and an enquiring investigative approach.

C13: Discuss the important applications of nanotechnology in pharmacy

2/4 - General and Transferable Skills:

D1: Develop the ability of working in a team through group presentation and group discussion with appreciation of leadership and innovation skills.

D2: Use reference books, internet, and previous knowledge for getting the information, demonstrating competency in managing a research project, writing a manuscript, making conclusions and selecting an appropriate pharmaceutical journal for publication.

D3: show good communication skills of others, to transfer knowledge and information provided by the course both verbally and written.

D4: Demonstrate various skills of self-learning, self and peer evaluation, data processing, time management, using information technology and ethics in scientific research.

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3- Academic Standards of Program Specification:

Academic Reference Standards (ARS) for Master's Degree in Pharmaceutical Sciences (Pharmaceutical Chemistry, PC)

4- External References for Standards (Benchmarks):

NA

5-Program Structure and Contents:

a- Program Duration: Minimum of Two years

b- Program Structure:

Subject Areas	Percentage
Basic Sciences Courses	36.8%
Specialized Courses	42.1%
Thesis	21.1%

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c- Program Course Levels (in credit-hours system):

No.	Course Code	Course Title	Credit Hours
1	PC 601	Physical Chemistry	2
2	PC 602	Pharmaceutical Nanotechnology	2
3	PL 601	Molecular Biology & Genetics	2
4	PM 601	Bioinformatics	1

<u>First Level (First Semester):</u> 7 Cr. (General courses)

First Level (Second Semester): 7 Cr. (General courses)

No.	Course Code	Course Title	Credit Hours
1	PC 603	Analytical & Instrumental Methods	2
2	PL 602	Molecular Basis of Drug Action	2
3	PP 601	Research Methods & Experimental Design	2
4	PL 603	Statistics & Biostatistics	1



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<u>Second Level (First Semester)</u>: 8 Cr. (6 Cr. compulsory specialized courses and 2 Cr. elective courses)

No.	Course Code	Course Title	Credit Hours
1	PC 704	Advanced Analytical Quality Assurance of Drugs	3
2	PC 705	Advanced Organic Pharmaceutical Chemistry	3
3		Elective Course	2

<u>Second Level (Second Semester):</u> 8 Cr. (6 Cr. compulsory specialized courses and 2 Cr. elective courses)

No.	Course Code	Course Title	Credit Hours
1	PC 706	Advanced Pharmaceutical Analysis	3
2	PC 707	Advanced Medicinal Chemistry	3
3		Elective Course	2

Thesis Research:

No.	Course Code	Course Title	Credit Hours
1	PC 800	Thesis Research	8

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d- Program Courses: a. Compulsory:

		No. of	Ηοι	ırs per W	eek	Grade &	
Course Code	Course Title	Units	Lect.	Lab.	Tut.	Level	Semester
PC 601	Physical Chemistry	2	2	0	0	First	First
PC 602	Pharmaceutical Nanotechnology	2	2	0	0	First	First
PL 601	Molecular Biology & Genetics	2	2	0	0	First	First
PM 601	Bioinformatics	1	1	0	0	First	First
PL 602	Molecular Basis of Drug Action	2	2	0	0	First	Second
PP 601	Research Methods & Experimental Design	2	2	0	0	First	Second
PL 603	Statistics & Biostatistics	1	1	0	0	First	Second
PC 603	Analytical & Instrumental Methods	2	2	0	0	First	Second
PC 704	Advanced Analytical Quality Assurance of Drugs	3	3	0	0	Second	First
PC 705	Advanced Organic Pharmaceutical Chemistry	3	3	0	0	Second	First
PC 706	Advanced Pharmaceutical Analysis	3	3	0	0	Second	Second
PC 707	Advanced Medicinal Chemistry	3	3	0	0	Second	Second
PC 800	Thesis Research	8	-	-		Second	First/Second

b. Elective:

Course Code	Course Title	No. of	Hou	ırs per W	/eek	Grade &	Semester
	Course Thie	Units	Lect.	Lab.	Tut.	Level	Semester
PC L08	Formulation Chemistry	2	2			Second Level	
PC L09	Drug Synthesis	2	2			Second Level	

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6- Program Courses Contents: I- Required Courses

Course Title	Physical Chemistry								
Course Code	PC 601	Credit Hours	Lecture	2	Tutorial	0	Practical	0	
Pre-requisite	Permissio	Permission of Instructor							
Department	Pharmace	Pharmaceutical Chemistry							

Course objectives:

This course is formulated to give the essential basis and principles underpinning research in pharmaceutical chemistry, pharmaceutics, phytochemistry, pharmacology and microbiology. The course provides conceptual and intellectual foundation for further studies in pharmaceutical sciences.

- Ionic equilibrium, acid-base equilibrium of functional groups, states of matter & phase equilibria.
- Thermodynamics, thermochemistry, the first law of thermodynamics, energy and enthalpy changes, the second law of thermodynamics, the Gibbs free energy and entropy, the third law of thermo-dynamics, the standard entropy, standard free energy and the Gibbs-Helmholtz relationship.
- Thermodynamics of electrochemical processes. Free-energy change & application to kidney transfer of urea from plasma to urine.
- Chemical kinetics and enzyme kinetics, factors affecting reaction rates, rate laws, half-life and determining rate equation.
- Mathematical treatment of zero-order, first –order & second-order reaction rates.
- Determination of expiry time of pharmaceutical preparations.
- Decomposition of medicinal agents (hydrolysis & oxidation).
- Accelerated stability analysis of drug substances.
- Electrochemistry, conductance, oxidation, reduction and the Nernst equation, dissociation constant & pH of medicinal agents.
- Physical chemistry of solutions and colligative properties.
- Solids, semisolids and solubility, interfacial active molecules& acid-base functional



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Course Title Pharmaceutical Nanotechnology Course Code PC 602 **Credit Hours** 2 2 Tutorial 0 Practical 0 Lecture Permission of Instructor Pre-requisite Department Pharmaceutical Chemistry

Course objectives:

The main objectives of this course are based upon the acquisition of knowledge and developing research abilities in the field of Pharmaceutical Nanotechnology, respective to the: a- Development of therapeutic nanosystems for the release and vectorisation of drugs with chemical and biotechnological origin, b- Chemical preparation & analysis of nanomaterial and the chemical study of nanostructures. This course has been developed to introduce students to the underlying principles and applications of the emerging field of nanotechnology, scientific principles and theory relevant at the nanoscale dimension and to discuss the current and future nanotechnology applications in physics, chemistry, biology, pharmacy and medicine. **Course content:**

- Introduction to the practice and discipline of nanotechnology.
- The fundamental science behind nanotechnology:
 - Overview of chemistry fundamentals for Nanotechnology.
 - Overview of physics fundamentals for Nanotechnology.
 - Biosystems and Molecular recognition.
- Nanostructures & Nanomaterials. •
- Nanofabrication & tools for measuring nanostructures.
- Materials characterization methods.
- Structural study of organic/inorganic nanocomposites.
- Surface, thin film and colloid chemistry.
- Nanobiotechnology.
 - Pharmaceutical nanotechnology:
 - Drug delivery systems, emulsions, microemulsions and multiple emulsions.
 - Micro-nano capsules and micro-nano spheres, liposomes and niosomes.



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Course Title Molecular Biology & Genetics Lectur 2 2 0 0 Course Code PL 601 **Credit Hours** Tutorial Practical e Pre-requisite Permission of Instructor Department Pharmacology

Course objectives:

Demonstrate an understanding of the current concepts of DNA structure, maintenance and repair. Introducing the students to the basics of molecular biology and biotechnology. Explain the processes involved in gene organization, replication and expression. Demonstrate an understanding of the tools used in recombinant DNA technology. Comment on the applications of genomics and proteomics. Explain the basic concepts of bioinformatics.

Course content:

- Basic principles in molecular biology.
- Macromolecular structure and interactions.
- Regulation of gene expression.
- Basis of inherited diseases and diagnostic molecular biology of genetic diseases.
- Genetic variation & DNA finger printing.
- Genomics, proteomics and bioinformatics.
- DNA cloning and manipulations, and gene therapy.

Course Title	Bioinformatics								
Course Code	PM 601	PM 601 Credit Hours 1 Lecture 1 Tutorial 0 Practical 0							0
Pre-requisite	Permissi	Permission of Instructor							
Department	Microbiology and Immunology								

Course objectives:

Introduce the scope of computational biology to graduate students of Pharmacy who have been completed their undergraduate degree. Familiarize the students with bioinformatics software and web-based applications. Acquire the ability to search for, analyze and submit molecular biology and gene technology data. Allow the students to learn how to access new information and to continue learning beyond the limits of this course.

- Definition, aims and components of bioinformatics.
- Biological archives and public organizations.
- Searching for drug side effects, interactions and publications.
- Comparative analysis of sequences.
- Protein structure and function and annotation of sequences.
- Bioinformatics tools for gene technology.
- Bioinformatics-based drug design.
- Genomics, proteomics and metabolomics.



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Course Title	Analytica	al & Instrun	nenta	al Methods					
Course Code	PC 603	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permissi	Permission of Instructor							
Department	Pharmac	Pharmaceutical Chemistry							

Course objectives:

This course is designed to provide the specialist essential fundamental background in pharmaceutical analysis and for other aspects of pharmaceutical sciences.

Course content:

- Chemical composition of aqueous solutions.
- Effect of electrolytes on chemical equilibria.
- Equilibrium calculations for simple and complex systems.
- Chemical calculations to determine concentrations of species of interest.
- Basic separations of chromatographic theory & application of this knowledge in identification and quantification of drugs.
- HPLC techniques for qualitative and quantitative analysis of drugs, impurities & degradation products.
- Development of HPLC stability-indicating methods for pharmaceutical products & for quantitation of drug combination.
- Basic properties of electromagnetic radiation & interaction between radiation and matter.
- Function of instrumental components used in spectrometry.
- Basic principles of applications molecular absorption & molecular fluorescence spectroscopy.
- Development of spectrophotometric methods for the quantitation of drug combination using ΔA , $D_1 \& D_2$ techniques & for determination of $K_a \& K_b$ of medicinal agents.
- Fundamental principles of electro-chemistry in terms of oxidation-reduction reactions.
- Electro-chemical calculations.
- Potentiometry, pH measurements and electrolysis in analysis of drug substance.



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Course Title	Molecula	Molecular Basis of Drug Actions					
Course Code	PL 602	PL 602 Credit Hours 2 Lecture 2 Tutorial 0 Practical 0					0
Pre-requisite	Permiss	Permission of Instructor					
Department	Pharmacology						

Course objectives:

This course is designed to promote the understanding of the molecular basis of drug action and explore how drugs interact with various targets in the body to exert therapeutic effects.

- Introduction: Molecular Approaches to Drug Mechanism.
- Molecular Pharmacology of Receptors:
 - Molecular basis of receptor subtypes.
 - Receptor-ligand interactions.
 - Signal transduction.
 - Biochemical and molecular aspects of G-protein coupled receptors and their signaling mechanisms.
- Molecular pharmacology of Ion Channels.
- Molecular Pharmacology of Enzymes.
- Hormone action and signal transduction.
- Protein Therapeutics.
- Cell Signaling in the Cardiovascular System.
- Cell Signaling in the Nervous System.
- Cell cycle checkpoints and anti-cancer drugs.
- Finding new drug targets to treat disease.
- Drug resistance/mechanisms.
- Genetic variability in drug action.
- Molecular mechanisms of drug tolerance.



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Course Title	Research	Methods &	k Exp	perimental	Des	ign			
Course Code	PP 601	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permissi	Permission of Instructor							
Department	Pharmac	eutics & Ph	arma	aceutical T	'echn	ology			

Course objectives:

This course is designed to enhance students' research skills by introducing general principles and procedures of research methodology and experimental design in the fields of pharmacy. Students should learn the accurate sampling techniques, data collection and analysis, hypothesis testing and interpretation of the results. Scientific writing will also be taught.

Course content:

- Research areas in various pharmacy disciplines.
- Drug literature retrieval and evaluation.
- Experimental design and methodology to optimize the in-vitro and in-vivo experiments.
- Design of single and multiple factors experiments (e.g. factorial design or others).
- Response surface design.
- Sampling techniques.
- Data collection, reliability, validity and analysis.
- Thesis preparation.
- Ethical conduct in research.

Course Title	Statistics	Statistics & Biostatistics					
Course Code	PL 603	L 603Credit Hours1Lecture1Tutorial0Practical0					0
Pre-requisite	Permissi	Permission of Instructor					
Department	Pharmac	Pharmacology					

Course objectives:

This course deals with the area of statistics and biostatistics from basic up to advanced topics from data collection, presentation, theory of probability, regression analysis, epidemiology and quality control.

- Data collection, presentation & distribution.
- Basic probability.
- Statistical building blocks.
- Confidence Intervals.
- Regression analysis (parametric and non-parametric).
- Tests of statistical significance: Paired, pooled t tests & analysis of variance.
- Epidemiology.
- Statistical quality control.
- Robust statistics.



كلية الصيدلة والتصنيع الدوائي

Course Title	Advance	d Analytica	l Qu	ality Assu	rance	e of Drugs			
Course Code	PC 704	Credit Hours	3	Lecture	3	Tutorial	0	Practical	0
Pre-requisite	Permissi	Permission of Instructor							
Department	Pharmac	Pharmaceutical Chemistry							

Course objectives:

This course teaches the key components of QA/QC and will help students to understand the need to produce sound scientific data using appropriate standards and controls, written procedures and method validation no matter what field they are employed in. This Course will offer a generic description of what is required in the formation of quality system in any laboratory. This will be achieved by describing the key principles in any QA/QC program with reference to the USP, ICH, FDA and ISO guidelines.

Course content:

- Introduction to QA/QC.
- Key elements of QA/QC program.
- Sampling operation and plans.
- Validation of analytical procedures.
- Qualification and calibration of instruments.
- System suitability testing.
- QC checks.
- Stability testing of new drug substances & products.
- Forced degradation study.
- Documentation in QA/QC.



كلية الصيدلة والتصنيع الدوائى

Course Title	Advance	d Organic F	harı	naceutical	Che	mistry			
Course Code	PC 705	Credit Hours	3	Lecture	3	Tutorial	0	Practical	0
Pre-requisite	Permissi	Permission of Instructor							
Department	Pharmac	Pharmaceutical Chemistry							

Course objectives:

The course is mainly based on reaction types, so that the student can be shown that despite the large number of organic reactions, a few principles suffice to explain nearly all of them.

Course content:

- Nomenclature of organic compounds including heterocycles.
- Aliphatic and aromatic nucleophilic substitutions, aliphatic and aromatic electrophilic substitutions, addition to C-C and C-hetero multiple bonds, elimination reaction, rearrangement and tautomerism.
- Naming of reactions.
- Acidity and basicity of organic compounds.
- Investigation of reaction mechanism.
- Reaction of some functional groups: phenolic, acidic, ketonic, carbanions and carbocations.



كلية الصيدلة والتصنيع الدوائى

Course Title	Advance	Advanced Pharmaceutical Analysis				
Course Code	PC 706	C 706 Credit Hours 3 Lecture 3 Tutorial 0 Practical 0				
Pre-requisite	Permissi	Permission of Instructor				
Department	Pharmac	Pharmaceutical Chemistry				

Course objectives:

To build on the content of Analytical & Instrumental Analysis (PC 603) by introducing more details in the fundamental aspects of pharmaceutical analysis. This course gives the details of various methods and techniques utilized in pharmaceutical analysis such as spectroscopic, chromatographic and electro-analytical techniques.

Course content:

- Potentiometric methods: General principles, reference electrodes, liquidjunction potentials, indicator electrodes, instruments for measuring cell potentials, direct potentiometric measurements & potentiometric titrations.
- Electro-gravimetric & coulometric methods.
- Molecular ultraviolet/visible absorption spectroscopy.
- Molecular-fluorescence spectroscopy.
- Atomic spectroscopy based upon flames.
- Infrared and Raman spectroscopy.
- Emission spectroscopy.
- Nuclear Magnetic Resonance spectroscopy: Theory and instrumentation, the chemical shift, time-dependence of NMR phenomena, spin-spin coupling, NMR spectroscopy of nuclei other than protons & analytical application.
- Mass spectrometry.
- Analytical separations: Separation by extraction & separation by ion exchange.
- Chromatographic methods: Migration rates of solutes, the efficiency of chromatographic columns, column resolution, application of chromatography, gas-liquid chromatography & high- performance liquid chromatography.



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Course Title	Advance	Advanced Medicinal Chemistry					
Course Code	PC 707	PC 707Credit Hours3Lecture3Tutorial0Practical0					0
Pre-requisite	Permissi	Permission of Instructor					
Department	Pharmaceutical Chemistry						

Course objectives:

To provide the student with the advanced fundamental aspects and current methodologies involved in drug discovery of lead compounds, drug development & drug production from different sources. To orient the student's attention to the importance of pharmacokinetic and the pharmacodynamic properties of drugs.

To reinforce a deeper pharmaceutical understanding of the mechanism of drug action (MOA), drug receptors and their classification, drug-target interactions, the structure activity relationship (SAR) of the studied drugs, and the fate and metabolism of drugs.

Course content:

- Enzyme inhibitors as therapeutic agents.
- Protein pharmaceuticals & the use of biotechnology in their production.
- Gene therapy.
- Selective estrogen receptor modulators (SERM).
- Novel targets for the design of anticancer agents.
- Prodrugs (Drug latentiations).
- Radiopharmaceutical.
- Nitric oxide & its role in physiological & pathophysiological states.
- Drug metabolism of some of the commonly used drugs.

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II- Elective Courses

Course Title	Formulat	Formulation Chemistry					
Course Code	PC L08	C L08Credit Hours2Lecture2Tutorial0Practical0					0
Pre-requisite	Permissi	Permission of Instructor					
Department	Pharmaceutical Chemistry						

Course objectives:

Students are shown how to predict and classify formulation excipients, use excipients in different classes of products, use standard methods for analysis of concentration-time profiles to obtain degradation rate constants, predict degradation mechanism to minimize degradation & appreciate complex kinetics involved in photo-oxidation degradation.

Course content:

- Classification of formulation excipients, these include: carbohydrates, polysaccharides, lipids, thickeners, lubricants, humectants, preservatives, organoleptics and synthetic polymer excipients.
- Physical and structural chemistry of the major classes of formulation excipients.
- General use of excipients in different classes of products.
- Use of standard methods for quantitative analysis of concentration- time profiles to obtain degradation rate constants, half-lives and shelf-lives.
- Mechanism of chemical degradation of typical organic drugs & excipients with emphasis on nucleophilic & free- radical reactions.
- Methods for minimizing the extent of degradation reactions to increase lifetimes of products.
- Complex kinetics in oxidation, photochemical and solid-state degradation.

Course Title	Drug Syr	Drug Synthesis					
Course Code	PC L09	CL09 Credit Hours 2 Lecture 2 Tutorial 0 Practical 0					0
Pre-requisite	Permissi	Permission of Instructor					
Department	artment Pharmaceutical Chemistry						

Course objectives:

This course deals with the identification of the most suitable methods for synthesis organic and medicinal compounds using the concept of retrosynthetic analysis.

- Synthesis of amino acids, peptides and nucleotides.
- Synthesis of some selected drugs including heterocyclic drugs.
- Functional group interconversion and protection of functional groups are illustrated.
- Separation of organic compounds using different chromatographic techniques.
- Retrosynthesis of some drugs.

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7- Program Admission Requirements:

Admission Requirements include:

- 1. Holders of bachelor's degree in Pharmaceutical Sciences minimum general grade Good (C+), or the equivalent of this grade from one of the universities recognized by the Supreme Council in the field of specialty, or from an equivalent foreign university.
- 2. In case the applicant is granted a Pass in his bachelor's degree and wants to register for a master's degree, he must obtain a specialty diploma with general grade (C +) at least, or pass the complementary courses determined by the department, with a general grade no less than (C+) and these courses are not part of the hours of the program.
- 3. The student gets the approval of the department council if he fulfills the terms set by the scientific department (if any) and then the approval of the faculty's Council.

8- Regulations Rules for Program Course Completion:

To obtain a Master's degree, 30 credit hours must be studied, in addition to 8 credit hours for the thesis, so that the total number of hours to obtain the degree is not less than 38 credit hours.

Teaching and Learning Method	Skills to be Achieved
Lectures	Knowledge, Understanding, Intellectual and Professional Skills
Research project Interactive modules; Self-Learning assignments, Group presentation/Discussion, Case study, Problem solving, Cooperative learning, Simulation and Videos	Knowledge, Understanding, Intellectual, Professional & Practical and General & Transferable Skills

9- Teaching and Learning Methods

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10- Methods and Rules of Student's Evaluation:

Methods	Program Intended Learning Outcomes
Written exams Final written exam (40%) Midterm exam (20%)	General knowledge & Understanding and Intellectual and Professional Skills
Oral exams (10%)	General Knowledge & Understanding, Intellectual, Professional and General Skills
Continuous assessment (30%)	General Knowledge & Understanding, Intellectual, Professional and General skills

• Examinations Procedure:

1. The final grade awarded to student in a course are distributed as follows:

- 30% for the continuous assessment.
- 20% for the mid-semester exam.
- 40% for the final written exam
- 10% for the oral exam

2. Each credit hour is allotted a total of 100 points.

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• Grading System:

Grade		Numerical Average	Grade points
Excellent	A+	100 – 97	4.0
Excellent	А	$90 \le X < 97$	3.85
Excellent	A-	$85 \le X < 90$	3.7
Very Good	B+	$80 \le X < 85$	3.3
Very Good	В	$75 \leq X < 80$	3.0
Good	C+	$70 \le X < 75$	2.7
Good	C	$65 \le X < 70$	2.3
Pass	D	$60 \le X < 65$	2.0
Fail	F	X < 60	0.0
Satisfactory	S	—	_
Unsatisfactory	US	—	_
In progress	IP		
Withdrawal	W	—	_
Military withdrawal	MW	_	_
Incomplete	Ι	—	
Excuse	Е	—	
No excuse	NE	0.0	0.0
Denial	DN	0.0	0.0

X = **Percentage Grade.**

 \sum Grade points x N° Cr. Hrs

Cumulative GPA =

 \sum Cr. Hrs



11- Evaluation of Program Intended Learning Outcomes:

Evaluator	Tool	Sample	% Contribution in total marks of program evaluation
Student	Questionnaires and periodic meeting	Questionnaires 20% and periodic meeting	25%
Graduates	Questionnaires and periodic meeting	Questionnaires 20% and periodic meeting	25%
Stakeholders (employers)	Questionnaires and periodic meeting	One meeting/year	25%
External evaluator	Reviewing of the specifications of the program and the courses according to the by law.	At least one reviewer professor in the specialty	25%

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