

Faculty of Pharmacy and Drug Manufacturing

Pharos University in Alexandria



Program Specification

**Master's Degree in
Pharmaceutical Sciences
(Pharmacology)**

إعتماد مجلس وحدة 10/8/2020

إعتماد مجلس كلية 12/8/2020



Index

<i>Content</i>	<i>Page</i>
Basic Information	2
Program Aims	2
Graduate Attributes	3
Intended Learning Outcomes	4
Academic Standards of Program Specification	7
External References for Standards (Benchmarks)	7
Program Structure and Contents	8
Program Courses Contents	13
Program Admission Requirements	29
Regulations Rules for Program Course Completion	29
Teaching and Learning Methods	29
Methods and Rules of Student's Evaluation	29
Evaluation of Program Intended Learning Outcomes	31



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

Program Specification

A- Basic Information:

1- Program Title: Master's degree in Pharmaceutical Sciences (Pharmacology)

2- Program Type: Single Double Multiple

3- Department (s): Pharmacology and Therapeutics (PL)

4- Program Coordinator: Prof. Soad Toaima

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

B- Special Information:

1. Program Aims:

The aim of the program is to produce postgraduates with advanced knowledge and understanding in the field of pharmacology, higher order critical, analytical, problem solving and transferable skills; ability to think rigorously and independently to meet higher level expectations of pharmaceutical industry, academics, and research. In addition to preparing researchers in some specialized fields including gene therapy, cell culture use in pharmacology, molecular pharmacology and neuropharmacology. In addition, the candidate will have a wide vision about development of new methods and tools to analyze and criticize any research scientifically, and to use different technological methods which add to his/her professional applications.



Graduate Attributes:

By the end of this program the graduates should be able to:

1. Have the opportunity to continue their postgraduate education by doing a thesis that involves extensive literature surveys and laboratory-based practical work which make them able to pursue a career in different fields.
2. Have the ability of self-learning, problem solving, critical and analytical thinking, working in a team professionally and be aware about his role in community development.
3. Recognize the role of instrumental chemistry in an industrial, academic and economic context and legislation of medicinal products and their analysis.
4. Identify a research topic, key research questions and principles as well as applications of biostatistics, implement ethics as well as basic methodologies of scientific research in the fields of pharmacology and prepare a comprehensive written report that is professionally presented and contains all the required components of a master's thesis.
5. Apply principles of basic physiological processes to systemic disease states, interpret the impact of pharmacogenomics on drug efficacy and adverse effects and deal with laboratory testing which can be performed on many types of fluids from the body using analytical procedures, instrumentation, automation, and lab mathematics.
6. Explore the molecular mechanisms of cancer development and neurodegenerative disease and Learn about the therapeutic application of stem cells biology and focus on the ethical and regulatory issues for this therapy.



2- Intended Learning Outcomes (ILOs):

2/1- Knowledge and Understanding:

By completion of the program, students should be qualified to:

A1: 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.

A2: Identify the different types of stem cells, stem cell lines culturing requirements, characteristics and applications of stem cells in biology and medicine.

A3: 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.

A4: Identify the etiology, treatment, prevention and appropriate treatment for the various diseases causing alterations in body function.

A5: Describe different analytical procedures, instrumentation, automation, and laboratory mathematics used in research.

A6: Explain the rationale for the usage of animal models in drug discovery and alternatives for animal models.

A7: Identify how to promote health, prevent and treat diseases in special populations: geriatric, pediatric as well as in pregnant and lactating females by providing basic information on pharmaceutical care for these populations.

A8: Recognize principles of immunology, including drugs affecting the immune system and the new trends of immunization and the use of immune modulators.

A9: Identify principles and applications of biostatistics.

A10: Demonstrate expertise in highly specialized and advanced research by the design, execution, and preparation of written and oral reports based on research investigation.

A11: Identify the general functions and importance of different biological fluids.

A12: Define the biochemical mechanisms and function of body systems and the biochemical processes disrupted in case of different disease states.

A13: 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.

A14: Define the basic rules and principles of physical chemistry (States of matter, buffers, law of thermodynamics, kinetics terminology).

A15: Recall rules needed for calculations to solve problems in different areas of analytical chemistry.

A16: 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.

A17: Illustrate the ability if using drug information resources and internet to acquire pharmaceutical knowledge.



2/2- Intellectual Skills:

By completion of the program, students should be qualified to:

- B1: 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 and their modulation by different pharmacological agents.
- B2: Discover the relation between the principles of pharmacokinetics and drug's therapeutic efficacy, toxicity and factors that modify responses to drugs.
- B3: 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.
- B4: Explain how structural and molecular biology, and modern enzymology have revolutionized the understanding of selective drug action and development of new therapies.
- B5: Analyze therapeutic strategies for both acute and chronic clinical conditions with considering the various variables that influence these strategies and risks in medical practice.
- B6: Illustrate different types of tumors, the role of tumor suppressor genes and oncogenes in cell cycle regulation and cancer onset, the biochemical role of growth factors and their receptors in the cancer developments.
- B7: Recognize the appropriate analytical instruments used in laboratory investigations and the appropriate correlations between the analyzed laboratory tests results and patients' medical condition according to validated laboratory techniques and calculations
- B8: Illustrate how to effectively present scientific data based on knowledge of biostatistics.
- B9: Plan a research protocol to conduct independent and effective study.
- B10: Explain synaptic neurotransmissions, mechanisms of neurodegenerative diseases and neurobiological applications in drug targeting.
- B11: Explain different types of stem cells, stem cell biology in medical applications and the barriers to regenerative medicine.
- B12: Outline the basics of the use of cell lines in drug screening, different types of instruments used in biological screening of drugs and different methodologies for in vivo modeling of various diseases.
- B13: Examine basic techniques of proteins, DNA & RNA extraction, separation and quantification.
- B14: Outline various immune modulators and new trends in vaccination for the management and prevention of different diseases.
- B15: Outline the physiological characteristics of geriatric, pediatric subjects as well as pregnant and lactating females to promote health, prevent and treat diseases in these special populations.



B16: Relate the pharmacological properties, therapeutic uses, side effects and contraindications to the use of different classes of drugs in endocrine and metabolic disorders, respiratory disorders, gastrointestinal and liver diseases, renal diseases and chemotherapy.

B17: Discover the scope of computational biology and bioinformatics software and web-based applications to analyze molecular biology and gene technology data for pharmaceutical research and drug design.

B18: Distinguish between the different orders of reactions and calculate the half-life time of drugs.

B19: Explain the interaction between electromagnetic radiation and matter on atomic and molecular levels.

B20: Apply validation concept whenever needed

B21: Criticize published evidence-based information and problem solving of relevance to Organic, Analytical and Medicinal Chemistry by the aid of computer technology.

B22: Select the proper HPLC conditions for separation and quantification.

B23: Evaluate information data from a variety of sources for planning different work strategies.

B24: Explain concepts of nanotechnology and its application in the field of pharmacological research.

2/3 - Professional skills:

By the end of this program the graduate should be able to:

C1: Develop research skills including knowledge of general principles and procedures of research methodology and experimental design in the fields of pharmacy.

C2: Develop competence and confidence in investigative research and dealing professionally with different pharmacological problems.

C3: Create comments on reports for situation related to the field of pharmacology including critical reviews of scientific articles and peer evaluation.

C4: Compile reviews and essays discussion competently for effective information management.

C5: Develop independent and self-critical learning ability by solving disease related cases.

C6: Design laboratory experiments and experimental results analysis and interpretation to investigate the mechanism of drug action and efficacy.

C7: Create skills required for conducting of standard pharmacological laboratory procedures and the usage of updated equipment related to the field of pharmacology appropriately.

C8: develop skills of using proper chemical formulas of different chemical compounds and calculations in different tasks.

C9: Apply spectrophotometry in qualitative and quantitative determination of drugs, as well as advanced analytical methods and operating related instruments in laboratory.

C10: Classify pharmacopoeial qualification, calibration & standardization and parameters for working safely in a laboratory.

C11: Evaluate standard methods for quantitative analysis of concentration-time profile.

C12: Discuss the important application of nanotechnology in pharmacy

C13: Discuss physical and chemical properties or changes taking place in a drug.



2/4 - General Skills:

By the end of this program the graduate should be able to:

- D1: Use internet to search relevant materials in textbooks and electronic sources.
- D2: Create skills of self-learning. group work and being effective as a leader or a member
- D3: Apply oral, written and poster presentations.
- D4: show problem solving skills by interpreting data, designing and carrying out experimental work.
- D5: Develop skills of handling advanced tasks within given time limits

3- Academic Standards of Program Specification:

Academic Reference Standards (ARS) for Master Degree of Pharmaceutical Sciences (Pharmacology) which was accredited in a faculty council on 9/4/2017.

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%

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

First Level (First Semester): 7 Credit hours (General courses)

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



First Level (Second Semester): 7 Credit hours (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

Second Level (First Semester):

8 credit hours (6 Cr. compulsory specialized courses and 2 Cr. elective courses)

No.	Course Code	Course Title	Credit Hours	إسم المقرر
1	PL 704	Advanced Pharmacology I	3	علم الأدوية المتقدم-I
2	PL 705	Advanced Pharmacology II	3	علم الأدوية المتقدم II-
3		Elective Course	2	مقرر اختياري

**Second Level (Second Semester):**

8 credit hours (6 Cr. compulsory specialized courses and 2 Cr. elective courses)

No.	Course Code	Course Title	Credit Hours
1	PL 706	Advanced Pharmacotherapeutics	3
2	PL 707	Applied Experimental Pharmacology	3
3		Elective Course	2

Thesis Research

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



d- Program Courses

a. Compulsory:

Course Code	Course Title	No. of Units	Hours per Week			Grade & Level	Semester
			Lect.	Lab.	Tut.		
PC 601	Physical Chemistry	2	2	—	—	First Level	First
PC 602	Pharmaceutical Nanotechnology	2	2	—	—	First Level	First
PL 601	Molecular biology and Genetics	2	2	—	—	First Level	First
PM 601	Bioinformatics	1	1	—	—	First Level	First
PC 603	Analytical & Instrumental Methods	2	2	—	—	First Level	Second
PL 602	Molecular basis of drug actions	2	2	—	—	First Level	Second
PP 601	Research Methods & Experimental Design	2	2	—	—	First Level	Second
PL 603	Statistics & Biostatistics	1	1	—	—	First Level	Second
PL 704	Advanced Pharmacology I	3	3	—	—	Second Level	First
PL 705	Advanced Pharmacology II	3	3	—	—	Second Level	First
PL 706	Advanced Pharmacotherapeutics	3	3	—	—	Second Level	Second
PL 707	Applied Experimental Pharmacology	3	1	4	—	Second Level	Second

**b. Elective courses:**

Course Code	Course Title	No. of Units	Hours per Week			Grade & Level	Semester
			Lect.	Lab.	Tut.		
PL L08	Therapeutics in Special Populations	2	2	—	—	Second Level	
PL L09	Pathophysiology of Human Disease	2	2	—	—	Second Level	
PL L10	Pharmacogenomics & Pharmacogenetics	2	2	—	—	Second Level	
PL L11	Immuno-Pharmacology	2	2	—	—	Second Level	
PL L12	Cancer Biology	2	2	—	—	Second Level	
PL L13	Analysis of Body Fluids	2	2	—	—	Second Level	
PL L14	Advanced Clinical Biochemistry	2	2	—	—	Second Level	
PL L15	Neurochemistry	2	2	—	—	Second Level	
PL L16	Biosciences of Stem Cells	2	2	—	—	Second Level	



6- Program Courses Contents:

I. Required Courses:

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

Course content:

- 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



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



Course Title	Molecular Biology & Genetics								
Course Code	PL 601	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
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	Credit Hours	1	Lecture	1	Tutorial	0	Practical	0
Pre-requisite	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.

Course content:

- 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.



Course Title	Analytical & Instrumental Methods								
Course Code	PC 603	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	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:

In depth knowledge and update information in the following areas with emphasis on research relevant issues:

- 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.



Course Title	Molecular Basis of Drug Actions								
Course Code	PL 602	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	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.

Course content:

- 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.



Course Title	Research Methods & Experimental Design								
Course Code	PP 601	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmaceutics & Pharmaceutical Technology								

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 & Biostatistics								
Course Code	PL 603	Credit Hours	1	Lecture	1	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	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.

Course content:

- 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.



Course Title	Advanced Pharmacology I								
Course Code	PL 704	Credit Hours	3	Lecture	3	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course deals with advanced principles of pharmacokinetics, pharmacodynamics, drugs affecting autonomic nervous system, neuromuscular junction and pharmacology of autacoids.

Course content:

In depth knowledge and update information in the following areas with emphasis on research relevant issues:

- Advanced principles of pharmacodynamics and pharmacokinetics.
- Factors modifying drug response.
- Classification and therapeutic relevance of drug interactions.
- Classification and therapeutic relevance of adverse drug reactions.
- Introduction to autonomic nervous system.
- Cholinergic neurotransmission and drugs modifying it (agonists and antagonists).
- Adrenergic neurotransmission and drugs modifying it (agonists and antagonists).
- Pharmacology of autocrine-paracrine mediators.

Course Title	Advanced Pharmacology II								
Course Code	PL 705	Credit Hours	3	Lecture	3	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course deals with advanced principles of neuro- and psychopharmacology as well as pharmacology of the blood and cardiovascular system.

Course content:

In depth knowledge and update information in the following areas with emphasis on research relevant issues:

- Analgesic drugs (narcotic and non-narcotic agents).
- Drugs used in Parkinsonism, Alzheimer, and Senile dementia.
- Sedative-Hypnotics, Antipsychotic, Antidepressant Drugs.
- Antiepileptic Drugs and Drugs used in Anaesthesia and CNS Stimulants.
- Drugs used in treatment of anemias.
- Anti-hyperlipidaemic drugs.
- Drugs used in disorders of blood coagulation, hypertension, coronary artery insufficiency, heart failure and cardiac dysrhythmias.



Course Title	Advanced Pharmacotherapeutics								
Course Code	PL 706	Credit Hours	3	Lecture	3	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course deals with advanced knowledge of endocrine and metabolic disorders, respiratory pharmacology, drugs for gastrointestinal and liver diseases, renal Pharmacology and chemotherapeutic agents.

Course content:

In depth knowledge and update information in the following areas with emphasis on research relevant issues:

- Thyroid gland hormones, thyroid drugs and antithyroid drugs.
- Hormone and non-hormonal agents acting on bone mineral homeostasis.
- Insulin and oral antidiabetic drugs.
- Pharmacology of corticosteroids, sex hormones, anabolic steroids and antiandrogens.
- Pituitary gland hormones.
- Rational treatment of allergic disorders and pharmacology of bronchial asthma.
- Rational basis for treatment of allergic rhinitis and urticaria.
- Drugs used in peptic ulcer and reflux oesophagitis.
- Antiemetic agents.
- Drugs used in bowel and liver disorders, diuretics, antidiuretics, drugs used in urinary motility disorders and urinary antiseptics.
- Chemotherapeutic agents for treatment of bacterial, viral, fungal and tuberculous infections.
- Cancer Chemotherapy.



Course Title	Applied Experimental Pharmacology								
Course Code	PL 707	Credit Hours	3	Lecture	1	Tutorial	0	Practical	4
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course is designed to deal with selected biological experiments intended to teach and train the student to prepare experimental animals, isolated tissues/organs preparation, cell lines and other advanced methodologies and evaluation techniques used to determine efficacy and toxicity of drug therapy.

Course content:

- Introduction to experimental methods.
- Laboratory safety, instruments and automation.
- Experimental studies and ethics; information resources of experimental procedures.
- *in-vivo* modeling of various disease (diabetes, inflammation, Nephrotoxicity, Hypertension,...).
- Use of isolated tissues/organs preparation in testing of drugs efficacy.
- Cancer modeling.
- Use of Transgenic animal in drug screening & bioevaluation.
- Use of Cell lines in drug screening & bioevaluation.
- Basics of proteins, DNA & RNA extraction, separation and quantification.



II. Elective Courses:

Course Title	Therapeutics in Special Populations								
Course Code	PL L08	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course aims to promote health, prevent and treat diseases in special populations: geriatric, pediatric as well as in pregnant and lactating females by providing basic information on pharmaceutical care for this population.

Course content:

- Definition of aging process, theories of aging and the physiological characteristics of geriatric, pediatric, pregnant and lactating subjects.
- The pharmacokinetics & pharmacodynamics characteristics at extremes of age (elderly & infancy), pregnancy and lactation.
- Common adverse drug reactions and interactions at extremes of age (elderly & infancy), pregnancy and lactation.
- Major cardiovascular, CNS, GIT and endocrine disorders at extremes of age (elderly & infancy), pregnancy and lactation.
- Common childhood infections, teething, allergy and febrile disorders.
- Definition and categories of drug Teratogenicity and Mutagenicity
- Evidence-based guidelines for prescribing at extremes of age (elderly & infancy), pregnancy and lactation.



Course Title	Pathophysiology of Human Disease								
Course Code	PL L09	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course is designed to promote the understanding of etiology, causes, treatment, prevention and appropriate treatment for the various diseases causing alterations in body function.

Course content:

- Cellular Injury, Inflammation, Fever and Healing.
- Diseases of Immunity.
- Neoplastic Disease
- Blood Disorders.
- Hemodynamic and Vascular Disorders.
- Cardiac Pathophysiology.
- Respiratory Pathophysiology.
- Gastrointestinal Pathophysiology.
- Hepatobiliary and Pancreatic Pathophysiology.
- Renal Pathophysiology.
- Endocrine Pathophysiology.
- Skeletal and Muscular Pathophysiology.
- Reproductive Disorders.
- Disorders of the Central Nervous System.
- Pain and trauma.



Course Title	Pharmacogenomics & Pharmacogenetics								
Course Code	PL L10	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course is designed to deal with the effect of genetic makeup on drug pharmacokinetics and pharmacodynamics and the sequences of gene expression as new therapeutic targets for treatments of different diseases.

Course content:

- Genetic structure of DNA and function. Pharmacogenetics and pharmacogenomics notions
- Functions and structures of RNA and proteins.
- Structures of genes and gene expressions; the method, variety and analysis of polymorphism.
- The importance of pharmacogenetics and pharmacogenomics in drug production and response.
- The changes depending on the genetic factors in drug pharmacokinetics and pharmacodynamics.
- The pharmacogenetics of enzymes in the drug metabolism.
- The pharmacogenetics of receptors in the drug metabolism.
- The pharmacogenetics of drug carriers in the drug metabolism.
- Pharmacogenomics and Proteomics.
- Gene therapy.



Course Title	Immuno-Pharmacology								
Course Code	PL L11	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course is designed to deal with the role of immune system in pathophysiology of various diseases and the new trends of the use of immune modulators to treat both autoimmune disorders and immune-deficiency status as well. Furthermore, this course will focus on the new trends of different diseases vaccination including cancer immune therapy.

Course content:

- Introduction to the immune system and its components.
- Different types of immune-responses (innate, adaptive & abnormal).
- Drug-Immune system interactions.
- Immunopathology of various diseases.
- Major Autoimmune disorders and the use of immunosuppressants.
- Immune deficiency and the use of immunostimulants & other different therapeutic approaches.
- New trends & guidelines of immunization.
- The use of Monoclonal antibodies for treatment of various diseases.
- Interrelation between Cancer & immune system and new trends in cancer immunotherapy and vaccination.
- The Major Histocompatibility reactions and trends of its modulation.



Course Title	Cancer Biology								
Course Code	PL L12	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

To explore the cellular and molecular mechanisms underlying cancer development with the aim of understanding how changes in the normal growth and division processes lead to the formation of tumors. To understand that nature consists of careful balances and that misregulation of fundamental cellular processes that leads to a cancer development. To understand that cancer is a multi-faceted disease; thus, cancer research and treatment must also be multi-faceted. To understand nucleic acid biology and its potential roles in disease progression and in therapeutics.

Course content:

- General aspects of gene regulation: transcription, regulation of the regulators, transcription factors in muscle cell development and transcription factors in oncogenesis.
- Oncogenes: identification of oncogenes and tumour suppressor genes, tumour suppressor genes or recessive oncogenes, dominant oncogenes involved in signal transduction and transformed cell phenotype.
- Cell cycle: the cell cycle, tumour growth, gene expression and cell proliferation and molecular biology of the cell cycle.
- Growth factors: autocrine stimulation, growth factors and their receptors, growth factors and malignancy, specific growth factors, growth inhibitory cytokines and growth factors and their receptors as targets for anticancer therapy.
- Cancer metastasis: the clinical significance of invasion and metastasis, heterogeneity of the metastasis, metastasis organ distribution, circulating tumour cell arrest and extravasation, three step theory of invasion, laminin receptors, tumour cell motility factors, proteinases and tumour cell invasion from correlation to causality, natural proteinases inhibitors are invasion suppressors, angiogenesis and tumour invasion are functionally related, metastasis and tumourgenecity can be under separate genetic control, metastasis suppressor genes and new strategies for metastasis diagnosis and therapy.
- Molecular approaches of cancer diagnosis: Proposes of molecular test in cancer diagnosis, molecular markers in cancer diagnosis and techniques for detection of molecular markers in cancer diagnosis.
- Hereditary factors and cancer: Chromosomal alterations, recessively inherited syndromes and dominantly inherited syndromes.
- Host anti-tumourgenecity mechanisms: Anti-oxidants and DNA damage and repair mechanisms.



Course Title	Analysis of Body Fluids								
Course Code	PL L13	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

This course is designed to deal with Laboratory testing which can be performed on many types of fluids from the body. These fluids analysis can give direct answers to what may be going on in a particular part of the body.

Course content:

- Blood serum.
- Urine.
- Cerebrospinal fluid.
- Peritoneal fluid
- Semen.
- Vaginal secretion.
- Bile.
- Pleural fluid.
- Saliva.

Course Title	Advanced Clinical Biochemistry								
Course Code	PL L14	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

The goal of this course is to provide students with a working knowledge of the theories and applications of Clinical Chemistry.

Course content:

- Introducing clinical biochemistry.
- Interpretation of results.
- Nutritional assessment.
- Lipoprotein metabolism.
- Clinical disorders of lipids.
- Skeletal muscle disorders.
- Screening the newborn for disease.
- Fluid and electrolyte balance and imbalance.
- Acid-base concepts and metabolic disorders.
- Renal and Liver function tests.
- Cardiac function tests.
- Glucose metabolism and diabetes mellitus.
- Calcium regulation.
- Endocrinology and its disorders.



Course Title	Neurochemistry								
Course Code	PL L15	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

The goal of the course is to provide the student with a sound multidisciplinary background in neurochemistry, molecular neurobiology, peptide chemistry and molecular biology. Neurochemistry research helps us to better understand molecular mechanisms behind neurodegenerative diseases.

Course content:

- Fundamental Principles of Neurotransmission Intracellular messengers.
- Acetylcholine, Glutamate and GABA.
- Adenosine, ATP, and Purinergic Signaling.
- Biogenic amines.
- Neuropeptides.
- Extracellular matrix.
- Inflammatory mediators.
- Neurotrophic factors and Neuroprotection.
- Molecular mechanisms of neurodegenerative disease.

Course Title	Biosciences of Stem Cells								
Course Code	PL L16	Credit Hours	2	Lecture	2	Tutorial	0	Practical	0
Pre-requisite	Permission of Instructor								
Department	Pharmacology								

Course objectives:

The course introduces key concepts in the field of stem cells, which will form the basis for exploring the properties of selected populations of adult and embryonic stem cells. The course will be devoted to applied topics that are essential to the therapeutic application of stem cell biology before focusing on ethical and regulatory issues and surveying the landscape for patenting and marketing of stem cell therapies.

Course content:

- Stem Cells: Definitions and Principles.
- Molecular Mechanisms of Pluripotency.
- The Stem Cell Niche.
- De-Differentiation and Induced Pluripotency.
- Hematopoietic and Mesenchymal Stem Cells.
- Neural, Cardiac and embryonic Stem Cells.
- Applied Topics in Stem Cell Biology.
- Mechanisms of Reprogramming for Neurodegeneration.
- Medical Applications of Stem Cell Biology and Cord Blood Stem Cells.
- Advances in Tissue Engineering.
- Barriers to Regenerative Medicine: Scientific, Ethical and Regulatory Issues.



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 no less than 38 credit hours.

9- Teaching and Learning Methods

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

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.**

- **Grading System:**

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

X = Percentage Grade.

$$\text{Cumulative GPA} = \frac{\sum \text{Grade points} \times \text{N}^\circ \text{ Cr. Hrs}}{\sum \text{Cr. Hrs}}$$



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%

Program Coordinator
Prof. Dr. Soad Toeima
Vice Dean of Faculty of Pharmacy
and Drug Manufacturing
Pharos University in Alexandria

Faculty Dean
Prof. Dr. Maged El-Ghazoly
Dean of Faculty of Pharmacy
and Drug Manufacturing
Pharos University in Alexandria