

# Pharm D program

## **PC 101 Pharmaceutical Analytical Chemistry I (2+1)**

Chemical Kinetics, rate of reaction, first order reaction, rate law, second order and third order of reaction, molecularity, Chemical equilibrium, Theories of reaction rate, activation energy and catalysis, Photochemistry, absorbed energy, quantum yield and chemical equilibrium. Introduction to general chemistry, Types of chemical reactions – calculations of concentrations of substances. Analysis of anions – Analysis of cations – Analysis of mixture of anions and cations.

## **PC 102 Pharmaceutical Organic Chemistry I (2+1)**

The objective of this course is to provide students with the basic knowledge in pharmaceutical organic chemistry, which will serve as fundamentals for other courses offered during subsequent semesters. This course involves Electronic structure of atom, alkanes [nomenclature, synthesis and reactions (free radical reactions)], and cycloalkanes. Stereochemistry (Optical isomers, racemic modification, nomenclature of configurations). Alkenes, alkadienes and alkynes. Alkyl halides (nomenclature, preparation and chemical reactions (SN1, SN2, E1, E2). Arenes and aromatic compounds (Kekule structure, Huckel rule, Electrophilic aromatic substitution and orientation). The practical sessions of this course help students gain skills required to purify and identify organic compounds of different classes such as aliphatic and aromatic aldehydes, ketones alcohols and hydrocarbons, halogenated hydrocarbons.

## **PC 203 Pharmaceutical Analytical Chemistry II (2+1)**

Acid-Base theory, titration curves, indicators, applications. Titrations in non-aqueous media, classification of solvents, theory, applications. Precipitometric titrations: solubility product principle, titration curves, Mohr's method, volhard's method, Fajans' method, pharmaceutical application. Complexometric reactions, theory, reaction with EDTA, indicators, applications.

## **PC 204 Pharmaceutical Organic Chemistry II (2+1)**

This course involves different classes of organic compounds: aryl halides, Alcohols, Phenols, ethers & epoxides, aldehydes, ketones, carboxylic acid & acid derivatives, sulphonic acids, and nitrogenous compounds.

## **PC 305 Pharmaceutical Analytical Chemistry III (1+1)**

Redox titrations, theory, oxidation potentials, Nernst equation, titration curves, redox indicators, selected oxidants and reductants, applications of redox titrations. Electrochemical methods, electrode potential, reference electrodes, indicator electrode, applications. Conductometric titration: ionic conductance, definition of cell constant, conductance, applications. Polarography: Ilkovic equation, dropping mercury electrodes, diffusion current, applications, derivatization polarography.

### **PC 306 Pharmaceutical Organic Chemistry III (2+1)**

This course involves: carbohydrates, amino acid & peptides, polynuclear and heterocyclic chemistry. In addition, it provides an introduction about the use of different spectroscopic tools, including UV, infrared (IR), nuclear magnetic resonance (NMR) and mass spectrometry (MS) for the structural elucidation of organic compounds.

### **PC 407 Instrumental Analysis (2+1)**

Spectroscopic methods of analysis which include uv/vis spectroscopy, principal, instrumentation, factors affecting absorption and applications in pharmaceutical analysis. Fluorimetric methods, principal instrumentation, factors affecting fluorescence intensity and applications in pharmaceutical analysis. Atomic spectroscopy; principal and instrumentation. Chromatographic methods for analytical chemistry which includes: TLC, gel chromatography, column chromatography, HPLC, UPLC, TLC, gas chromatography, capillary electrophoresis. The course also covers applied pharmaceutical analysis such as water analysis (water hardness, analysis of chloride, chlorine, iron, oxidizable matter, in water).

### **PC 508 Medicinal Chemistry I (2+1)**

This course is tailored to assist the students to gain the drugs affecting the autonomic nervous system (ANS), drugs acting on the cardiovascular system (CVS), CNS. The course handles different classes of antibiotics and antimicrobials (natural and synthetic), beside other synthetic chemotherapeutic agents (including antivirals, antifungals and antiparasitics). Additionally, various anticancer therapies, steroidal hormones and related drugs are also covered.

### **PC 609 Medicinal Chemistry II (2+1)**

The course is tailored to assist the students to gain the drugs affecting neurodegenerative disorders. Moreover, endocrine-related drugs (Diabetes, thyroid and calcium-regulating agents), antihistamines (H1, H2 blockers and anti-ulcer PPIs), drugs controlling pain and inflammation (NSAIDs, local anaesthetics and rheumatoid drugs) are also handled.

### **PC 710 Drug Design (1+1)**

The prime objective of this course is to prepare the students for professional practice by understanding the essentials of Medicinal Chemistry, and how the drugs, biological and toxicological activities are strongly correlated to their chemical structures (Structure-activity relationship; SAR), physicochemical properties and metabolic pathways. Focusing on patient-directed clinical care, the molecular aspects governing drugs' pharmacokinetics (ADME), pharmacodynamics, optimization of drug action, possible side effects, in addition to understanding drug interactions are targeted. In terms of

chemistry, SAR, mechanism of action and side effects. The course is also designed to familiarize the students with drug design and molecular modelling covering structure-based and ligand-based drug design. This also includes the process of drug discovery and development from target identification until approval of a new drug. Much concern is given to lead structure identification, optimization and targeting certain receptors and enzymes active sites. Additionally, the course addresses the study of molecular docking, pharmacophore generation, and molecular modifications including prodrug design, stereochemistry alterations, isosteric replacement, drug metabolism and Quantitative Structure-activity relationship (QSAR).

### **PC 011 Quality Control of Pharmaceuticals (2+1)**

The course is shared with departments: Microbiology & Chemistry:

- 1) Quality control & quality assurance of pharmaceuticals. The course has to be designed for quality control microbiology professionals, quality assurance or regulatory affairs personnel who have responsibility for the performance of Bioburden, Endotoxin & Sterility Testing or for data review, pharmacists performing sterile compounding. Principles, methods and procedures of different quality control tests used for evaluation of safety, potency and palatability of pharmaceutical products of small and large molecules drugs (biologicals) including herbal drugs have to be taught. The standard pharmacopeial methods and procedures as well as international guidelines as WHO, EMA, TGA should be discussed.
- 2) Good Analytical Practice and Sampling: Introduction, Sampling of pharmaceuticals and related materials, Type of sampling tools, Sampling plans.
- 3) Documentation.
- 4) Validation of analytical methods according to ICH Guidelines Q2 R1. Compendial testing, Validation of analytical methods, Data elements required for assay validation.
- 5) Drug stability, stability studies and stability indicating methods Drug stability, Stability testing, forced degradation studies, stability indicating assay methods for drugs according to ICH Q1 R2 Guidelines. Stress conditions for drug degradation according to ICH Q1 R2 Guidelines. Factors affecting drug degradation, Drug expiration, Drug withdrawal from the market. Pharmaceutical regulations according to FDA & EMA (European medicine agency) and ISO and BSI. Drug-excipient interactions and adduct formation; analytical techniques used to detect drug-excipient compatibility, mechanism of drug-excipient interactions, examples.
- 6) Official methods of analysis applied to raw materials and end products.

### **PB 201 Cell Biology (1+1)**

The cell theory and cell structure (membranous and non-membranous organelles, cell inclusions and the nucleus, macromolecules of the cell), DNA and genetic code, Cell cycle and control of cell number, from gene to protein (transcription, protein synthesis, folding of peptides), Transport of biomolecules across membranes, Cellular energetics, Ions and voltages, Intercellular communication.

### **PB 402 Biochemistry I (2+1)**

Proteins (protein structure, biologically important peptides, fate of proteins), Amino acids as precursors for biosynthesis of biomolecules (e.g. neurotransmitters, nucleotides), Carbohydrates (glycoproteins and proteoglycans, glucose transporters), Lipids (physiologically important lipid molecules, cholesterol and steroids, lipoprotein metabolism), Enzymology (enzyme kinetics, regulation, enzyme inhibitors as drugs), Hemoglobin and porphyrins (Hb derivatives and types metabolism of Hb and regulation), Biological oxidation and ATP synthesis, Clinical correlations.

### **PB 503 Biochemistry II (2+1)**

Energy production from dietary fuels (carbohydrates, lipids and proteins), Integration of metabolism (Feed/fast cycle, diabetes mellitus, obesity), Nitrogen metabolism and nitrogen balance, Hormonal regulation of metabolism, Biosignaling, Inborn errors of metabolism, Biochemistry of cancer, Biochemistry of aging, Food biochemistry (milk, probiotics), Free radicals and antioxidants.

### **PB 704 Clinical Biochemistry (2+1)**

Biochemical/pathophysiological changes and laboratory diagnostic markers for disorders of (Endocrine glands, renal function, hepatic function, gastric function, bone and mineral metabolism, plasma proteins and lipoproteins), Clinical enzymology and myocardial infarction, Electrolytes, blood gases and acid-base balance, Handling, preservation, storage and analysis of biological samples, Homeostasis and biochemical aspects of hematology and blood analysis, Urine analysis, Tumor markers, Recent diagnostic biomarkers.

### **PG 101 Medicinal Plants (2+1)**

The aim of the course is to provide students with knowledge necessary to identify and prepare a crude drug from the farm to the firm. Students should acquire knowledge concerning dusting powders, plant cytology, physiology and medicinal leafy plants and their taxonomy. In this course, the student will study: importance of natural products, preparation of natural products-derived drugs including collection, storage, preservation and adulteration. The course will introduce the students to the different classes of secondary metabolites. In addition, the course will discuss and address the variability in occurrence of pharmacologically active substances in certain official medicinal leafy plants according to their WHO monographs.

### **PG 202 Pharmacognosy I (2+1)**

Based on the Egyptian flora and other floras of wild and cultivated medicinal plants that are used in the pharmaceutical, cosmetic and food industries in the global & Egyptian market. The course introduces students to some botanical drugs of leaves, flower, seeds, bark and wood origin. During the lectures and practical sessions, students learn to identify examples of these drugs in their entire and powdered forms. Student will learn about the major constituents, folk uses, clinically proven uses, benefits, precautions of those medicinal plants. Possible herbal-drug interactions of selected examples of

these drugs and to have an overview over their phytopharmaceuticals available on the market specially the Egyptian market.

### **PG 303 Pharmacognosy II (2+1)**

After completion of the course the student should have the knowledge and skills that enable the student to differentiate between different organs of through their monographs. The course comprises the study of identification of different organs through their monographs. (Fruits, herbs, subterranean organs, unorganized drugs in addition to drugs of marine and animal origin) , including identify their active constituents and adulterants describe micro- and macro-morphological characteristics, benefits and precautions of their medicinal uses., side effects and contraindications and to have an overview over their phytopharmaceuticals available on the market specially the Egyptian market.

### **PG 504 Phytochemistry I (2+1)**

Based on complementary medicine and Egyptian medicinal plants that can be used as natural extracts, bioactive raw materials and phytochemical standards to serve the pharmaceuticals, cosmetics and food industries in Egypt. The course aims to gain students the knowledge and skills that enable them to understand, describe and deal with the chemistry of tannins, resins, miscellaneous terpenoids, bitters of plant or animal origin, carbohydrates and glycosides of plant or animal origin and different techniques used for their preparation, identification and determination. Also, the students should become aware of different chromatographic methods used for isolation and analysis of different plant constituents and their pharmacological actions and medicinal uses.

### **PG 605 Phytochemistry II (2+1)**

In continuation with Pharmacognosy I, this course aims to enable students to demonstrate the knowledge and experience that enables her/ him to understand, describe and deal with the chemistry of alkaloids, volatile oils and antioxidants of plant, fungi or animal origin as well as techniques for their isolation, identification and determination in their respective sources. Finally, the course focuses on the structure activity relationships (SAR) of these natural products derived compounds and their pharmacophoric features.

### **PG 706 Applied and Forensic Pharmacognosy (1+1)**

The course aims to provide pharmacy students with sufficient knowledge concerning quality control from herbal aspects, Sampling, structural, physical and analytical standards, purity, safety and adulteration of drugs and their detection. It also covers the modern chromatographic techniques employed for the evaluation of natural product and their products. It also provide the student with basic knowledge about the application of plant biotechnology for the production of pharmaceutically active materials. The course also includes an overview on forensic pharmacognosy including plants and their natural products that constitute health hazards, or intended for criminal uses to produce, abortion, loss of mental control, hallucination, heart arrest. Also, it includes the study of drug dependents, narcotics, analgesics psych

energetics, euphoric. Mycotoxin as a serious threat to general health and safety of community, contamination of food material with poisonous fungi.

### **PG 907 Phytotherapy and Aromatherapy (2+1)**

Upon successful completion of this course, the students should be able to know guidelines for prescribing herbal medicinal drugs on the basis of the pharmacological properties of these drugs including therapeutic uses, mechanism of action, dosage, adverse reactions, contraindications & drug interactions. The course also allows students understand pharmacotherapeutic principles applied to the treatment of different diseases, pharmacovigilance and rational use of drugs. Also, the student should understand the basis of complementary and alternative medicine with emphasis on herbal remedies, nutritional supplements, homeopathies, aromatherapy & their effect on maintaining optimum health and prevention of chronic diseases. It includes studying of medicinal plants portfolios in relation to Phytopharmaceuticals in Egyptian Market.

### **PT 101 Pharmacy Orientation (1+0)**

This is a course to acquaint the beginning pharmacy student with the multiple aspects of the profession of pharmacy, including the mission of pharmacy, role of pharmacist in society and pharmacy careers, classification of medications, interpretation of prescriptions and medication orders, general dispensing procedure and factors affecting drug dosage, sources of drugs, different dosage forms and various routes of administration. In addition to the history of pharmacy practice in various civilizations.

### **PT 202 Physical Pharmacy (2+1)**

This course provides students with knowledge of physicochemical principles essential for the design and formulation of pharmaceutical products. Students are introduced to the fundamental concepts of states of matter, Phase equilibrium, colligative properties, isotonicity solubility, dissolution, partition coefficient, surface and interfacial phenomena, surface active agents, adsorption and its application in pharmacy and rheological behaviour of dosage forms.

### **PT 303 Pharmaceutics I (2+1)**

This course is a study of the system of weights, measures, mathematical expertise and pharmaceutical calculations requisite to the compounding, dispensing, and utilization of drugs in pharmacy practice. It is also concerned with all manufacturing formulations aspects, packaging, storage and stability of liquid dosage forms including solutions (aqueous and non-aqueous), suspensions, emulsions and colloids with emphasis on the technology and pharmaceutical rationale fundamental to their design and development. The incompatibilities occurring during dispensing are also considered.

### **PT 404 Pharmaceutics II (2+1)**

This course covers the structure and function of the skin, target area of treatment after topical application to skin, basic principles of diffusion through membranes and factors affecting percutaneous absorption, enhancement of skin penetration, transdermal drug delivery systems (TDDS). It also describes the principles and techniques involved in the formulation and manufacturing of traditional dermatological semisolid dosage forms (creams, ointments, gels and pastes) and cosmetic products.

### **PT 505 Pharmaceutics III (2+1)**

The course introduces the students to the kinetics of drug decomposition including rate and order of the reaction, determination of the half-life, expiry date and shelf-life by different methods, stability testing, and in-vitro possible drug/excipients interactions. It also describes the principles and techniques involved in the formulation, and manufacturing of solid dosage forms including powders, granules, tablets, capsules and suppositories.

### **PT 606 Biopharmaceutics and Pharmacokinetics (2+1)**

This course aims to provide students with an understanding of the relation between the physicochemical properties of the drug and its fate in the body. The course explores the principles of biopharmaceutics and strategies for enhancing drug delivery and bioavailability. Integration of knowledge gained from other courses is emphasized to design and assure the quality of drug products. Students will also be introduced to the principles of pharmacokinetics (absorption, distribution, metabolism and elimination). The concepts of bioequivalence, biowaivers and in vitro-in vivo correlations (IVIVC's) will be discussed along with different models of drug disposition. The course prepares students for their evolving role in utilizing pharmacokinetics to guide formulation, dosage-regimen design and optimizing drug usage.

### **PT 607 Pharmaceutics IV (2+1)**

This course involves principles of formulation, development, sterilization, packaging and quality control testing of pharmaceutical sterile drug products. Principles for calculation and manipulation of parenterals, ophthalmic preparations, vaccines and blood products are emphasized. The course also covers the basic principles of formulation, sterilization, packaging and applications of radiopharmaceuticals in pharmacy and medicine. An in depth study on the formulation, manufacturing, quality control testing and applications of aerosols and other inhalation products is also accentuated.

### **PT 708 Pharmaceutical Technology I (2+1)**

The course provides students with an introduction to industrial pharmacy. It deals with the principles of various unit operations such as heat transfer, evaporation, drying, distillation, filtration, centrifugation, crystallization and extraction. It focuses on the application of these unit operations in pharmaceutical industry with emphasis on the equipment and machines used during the production of different dosage forms.

### **PT 809 Pharmaceutical Technology II (2+1)**

This course is a continuation of the study of the various unit operations in pharmaceutical industry with emphasis on size reduction, size separation, size analysis and size enlargement involved in the process development, scale-up and manufacturing of pharmaceutical drug products in industry (conventional / advanced nanotechnology based). In addition to the container/closure systems, some of the packaging processing methods are covered. Moreover, the vision about designing a quality product and its manufacturing process to consistently deliver the intended performance of the product to meet patient needs is discussed by applying Quality-by-Design principles.

### **PT 910 Good Manufacturing Practice (1+1)**

This course involves the principles of the Current Good Manufacturing Practices (cGMP). It exposes students to all aspects of validation, calibration, inspection and the requirements for manufacturing facilities. It also provides students with a review of the process engineering, technology transfer, personnel management, training and hygiene, premises and contamination control, documentation and auditing, process deviation with emphasis on risk management, complaint handling and product recall theory.

### **PT 011 Advanced Drug Delivery Systems (1+1)**

The course aims to provide students with insights and competencies related to the principles of pharmaceutical pre-formulation as a gateway to dosage forms design and formulation. Emphasis is placed on developing formulations based on the physical and chemical properties of the drug substance and the intended use of the drug product. The course also introduces the students to the formulation principles and applications of novel and targeted drug delivery systems by transforming proteins, genes, and other biotechnology driven compounds into therapeutic products. In addition to formulation aspects of biotechnology derived pharmaceuticals, it also covers the application of polymers and excipients to solve problems/issues concerning the optimization of absorption, selective transport, and targeting.

### **PM 401 General Microbiology and Immunology (2+1)**

The course provides students with a combination of laboratory and theoretical experience exploring the general aspects of microbiology. It includes knowledge of microorganisms, their morphology, diversity, cell structure and function, cultural characteristics, growth, metabolism, role of microorganisms in infectious diseases and microbial pathogenesis. It also clarifies different mechanisms of transport across bacterial cell membrane, metabolic pathways and physiology of bacteria. The course also covers the principles of genetic characters including DNA and RNA structures, replication, different forms of mutation and mutagenic agents. It also explores the basic concepts microbial growth, cultivation and reproduction. Moreover, it introduces the modern concepts of medical immunology, with an emphasis on Host parasite relationship, Non-specific and specific immunity, Mechanism of protective immunity. Molecular and cellular immunology, including antigen and antibody structure, function and reaction between them, effector mechanisms, complement, and cell mediated immunity. Active and passive immunization. Hypersensitivity and in vitro antigen antibody reactions, Immuno-deficiency disorders, Autoimmunity and auto-immune disease, organ transplantation.

### **PM 502 Pharmaceutical Microbiology (2+1)**

This course describes in detail the physical and chemical methods of bacterial eradication and how to effectively control microbial growth in the field of pharmaceutical industry / hospitals. It further describes the means of preservation of pharmaceutical products, as well as cosmetics, followed by the proper tests of quality control and sterility assurance. Sterilization, sterilization indicators, sterility testing, aseptic area, the microbiological quality of pharmaceuticals. Validation of sterilization process. Moreover, it explains the different groups of antimicrobials, their mechanism of action and resistance of microbes to biocides. Microbiological evaluation of antiseptics, disinfectants and preservatives. Antibiotics, classification and mechanism of action, Antiviral and antifungal agents, different classes of antibiotics including the new categories and new approaches to overcome bacterial resistance & antibiotics clinical abuse.

### **PM 603 Parasitology and Virology (2+1)**

Part of this course will focus on parasitic infections of humans with knowledge concerning biological, epidemiological and ecological aspects of parasites causing diseases to humans. It concerns with different parasitological related diseases in in Egypt causing serious health problems. This part of the course will discuss medical helminthology, protozoology and entomology concerning their morphological features, life cycle, pathogenesis, clinical manifestations, different diagnostic techniques, the most recent lines of treatment and prevention with control strategy for each parasitic infection. Moreover, it also covers laboratory diagnosis of human parasitic infections. The other part of the course provides students with the essential knowledge to recognize the epidemiology, mechanisms of pathogenesis, clinical picture, methods of laboratory diagnosis, treatment, prevention and control measures of RNA and DNA viral infections in humans.

### **PM 704 Medical Microbiology (2+1)**

The course aims at studying microorganisms causing infectious disease in human beings. The infectious diseases, their etiology and clinical manifestation, routes of transmission, treatment and techniques in detection and identification of pathogenic microorganisms caused by Gram positive cocci& bacilli, Gram negative cocci& bacilli and mycobacteria of major significance to public health will be studied.

### **PM 905 Biotechnology (2+1)**

The course aims to provide students with fundamentals, scope and applications in biotechnology through studying fermentation technology, upstream, downstream, scaling up and down processes, use of molecular techniques for production of recombinant products and other major biotechnological products, biotransformation, bioremediation, bioleaching, bioinsecticides, biosurfactants and biopolymer production.

**PM 906 Public Health (2+0)**

This course aims at understanding all scientific disciplines required for health education and promotion directed to the community health. How epidemiology acts as the bases of public health actions will be taught. Detailed scientific information and practices programs will be provided for control of communicable, non-communicable diseases, improving mental, social, environmental, occupational, geriatric and family health, use of sufficient and balanced food and nutrition, supplying safe drinking water, treating and disposing wastes and proper intervention during disasters.

**PO 401 Biostatistics (1+0)**

This course provides basic concepts of biostatistics and data analysis. It includes introduction to descriptive and inferential statistics, interpretation of estimates, confidence intervals and significance tests, elementary concepts of probability and sampling; binomial and normal distribution, basic concepts of hypothesis testing, estimation and confidence intervals, t-test and chi-square test, linear regression theory and the analysis of variance.

**PO 502 Pharmacology I (2+1)**

The general principles of pharmacology are presented; such as pharmacokinetics, pharmacodynamics, receptor theory, drug interaction and principle of therapeutics. This course integrates principles of pharmacology with conceptual knowledge of physiology and pathophysiology to disease processes regarding the autonomic, neuromuscular and autacoids.

**PO 603 Pharmacology II (2+1)**

This course integrates principles of pharmacology with conceptual knowledge of physiology and pathophysiology disease processes regarding drugs acting on cardiovascular systems, central nervous system, gastro-intestinal tract, pulmonary systems and hematologic disorders. Antihyperlipidemic drugs are also included.

**PO 704 Pharmacology III (2+1)**

This course integrates principles of pharmacology with conceptual knowledge of physiology and pathophysiology disease processes regarding drugs acting on endocrine system. Chemotherapeutic drugs including antimicrobials, anticancer and immunosuppressant are within the scope of the course. Stem cell therapy is also included. The anti-inflammatory, analgesics as well as gout treatments are also included.

**PO 805 Toxicology & Forensic Chemistry (2+1)**

This course provides basics and concepts of toxicology including the mechanism of toxicity, target organ and treatment of toxicity. Toxic groups including heavy metals, toxic gases, animal, plant and marine poisons, pesticides and radiation hazards are covered. Environmental, occupational, reproductive and

genetic toxicology as well as drug abuse are included. Postmortem sampling for detection of poisons, methods of detection, interpretation of results and writing of a report are also covered.

### **PP 006 Drug Interaction (1+1)**

The course is shared between 2 departments: Pharmacology & Pharmacy Practice This course provides the knowledge and skills enabling them to develop professional competencies in the recognition and discussion of the pharmacological aspects of drug-drug, drug-chemical, drug-herb or drug-food interactions and their clinical significance as well as the application of that knowledge to minimize the risk and outcome of interactions. It covers different types of drug interaction including pharmaceutical interactions, pharmacokinetic interactions, pharmacodynamic interactions, herbal & food drug interactions, alcohol and smoking drug interactions, CNS drug interactions, interactions of cardiovascular acting drugs, interactions of anticoagulants, interactions of anti-infectives, interactions of antihistamines & immune-based therapies, interactions of hormones, and drug-disease interactions. The course is designed to familiarize students with the major types of drug interactions (Pharmacokinetic, pharmacodynamic and pharmacogenetic interactions) in the clinical setting, in addition to drug food and drug disease interactions. The course comprises digitalis drug interactions, anticoagulants, hypoglycemic interactions, antineoplastic drug interactions, antihypertensive interactions and anticonvulsant Interactions. Students will be expected to determine whether a given interaction is clinically significant or required pharmacist intervention, make rational, scientifically recommendations for management of drug interactions.

### **MD 101 Medical Terminology (1+0)**

Introduction to medical and pharmaceutical terminologies, medical abbreviations, medical idioms, suffixes and prefixes, medical terms pertaining to major body systems.

### **MD 202 Anatomy and Histology (2+1)**

Histology: Cytology, various tissues (epithelial, connective, muscular, and nervous), heart, blood vessels, lymphatic organs, skin and its appendages, systems (digestive and associated glands, respiratory, urinary, reproductive, and central nervous system), endocrine glands, and eye. Anatomy: Introduction to skeletal, muscular, and articular systems, fascia, nervous, cardiovascular, and lymphatic systems, digestive, respiratory, and urogenital systems, endocrine glands. Cytology: blood, liver, spleen, lung, kidney, lymph node, cardiac muscle, aorta, stomach, and intestine.

### **MD 203 Psychology (1+0)**

The course introduces different principles, theories and vocabulary of psychology as a science. The course also aims to provide students with basic concepts of social psychology, medical sociology and interpersonal communication which relate to the pharmacy practice system that involves patients, pharmacists, physicians, nurses and other health care professionals.

### **MD 304 Physiology and Pathophysiology (2+1)**

Physiology: Introduction to body water, homeostasis, transport of materials, nervous systems, neuron structure and function (reflex arc), cardiovascular system, blood, respiratory cycle, gastrointestinal, reproductive, and renal systems, endocrine glands and body temperature regulation. Pathophysiology: Introduction to pathophysiology, cell injury, inflammation and immune response, autonomic nervous system in health and disease, endocrine disorders, pancreatic disorders, fluid and electrolyte imbalance, vascular and hematological disorders, disease of urinary, pulmonary and digestive systems.

### **MD 405 Pathology (1+1)**

The main aim of Pathology course is to provide the second-year student with knowledge and skills for common diseases affecting body organs and system. It helps the student to understand the causes (etiology) of disease, the mechanisms of its development (pathogenesis) and the associated alterations of structure (morphologic changes) and function (clinical manifestations and complications) to be able to determine the most likely diagnosis of the disease.

### **MD 006 First Aid (1+0)**

The course covers topics of basic life support and medical emergency of different situations including bleeding, shock, poisoning, bone fractures, soft tissue injuries, rescue and transportation. It includes: introduction to first aid ABCs, medical emergencies, effect of temperature, transportation of an injured casualty & first aid kit, respiratory emergencies, fractures and dislocations, bleeding and surgical emergencies, burns and scalds, animal bites or stings and poisoning.

### **PP 801 Clinical Pharmacokinetics (2+1)**

This course provides basic principles of pharmacokinetics and their application to the clinical setting. Single Intravenous bolus and oral kinetics, IV infusion, multiple IV bolus, short infusion & oral dosing, non-linear pharmacokinetics, pharmacokinetic models. Sources of variability in pharmacokinetics, dosage regimen and dosage adjustment in children, obese, elderly patients and chronic disease states. Therapeutic drug monitoring and pharmacogenomics approaches.

### **PP 802 Hospital Pharmacy (1+1)**

The course aims to introduce students to hospital pharmacy organization, structure, management and related activities on both technical and administrative levels in accordance with national and international established guidelines. Administrative services include: the pharmacy, the pharmacy and therapeutic committee and policy making, the hospital formulary, medication purchasing, distribution and dispensing systems. The pharmaceutical (technical) services include: preparation of Intravenous (IV) admixtures, total parenteral nutrition (TPN) fluids, renal dialysis fluids, dispensing and safe handling of radiopharmaceuticals, cytotoxic drugs, and medical gases.

### **PP 803 Community Pharmacy Practice (2+1)**

The course provides students with competencies and knowledge for the provision of quality pharmaceutical care in a community pharmacy setting aiming at improving use of medicines and therapeutic outcomes. The course covers differentiation between minor and major ailments and responding to minor ailments with over-the-counter products. It also provides concepts of patient assessment, counselling, and monitoring in community pharmacy and in outpatient care settings and introduces students to pharmaceutical care services for chronic-diseased outpatients and to psychosocial aspects in patient care. In addition, the course provides the students with competencies to promote the public health role of pharmacist including health promotion and disease prevention activities.

### **PO 804 Drug Information (1+1)**

This course introduces the student to the concept and need of drug information, types of drug information resources (primary, secondary and tertiary literature), computerized and online drug information, literature evaluation and critical appraisal, retrieval of information. It also aims at providing the students with the professional skills required to effectively and accurately answer medication-related questions in a systematic and evidence-based approach.

### **PP 904 Clinical Pharmacy I (2+1)**

Definition and concepts of clinical pharmacy and pharmaceutical care, and qualification to become a clinical pharmacist. Patient history, medication reconciliation, therapeutic planning and drug-related problems. Interpretation of clinical laboratory data and physical examination. Providing Medication Therapy management services. Principles of special care populations (geriatric, pediatric, renal and hepatic patients, obesity & pregnancy & lactation). The course also introduces the student to the principles of management and supportive care of oncological diseases, blood disorders and nutritional deficiencies.

### **PP 006 Clinical Pharmacy II and Pharmacotherapeutics (1+1)**

The course introduces the student to the principles of pharmacotherapeutics & management of the common disease states (e.g. cardiovascular diseases, gastrointestinal diseases, respiratory diseases, endocrine diseases, obstetrics and gynecology, rheumatic diseases, renal diseases, CNS diseases).

### **PP 007 Clinical research, Pharmacoepidemiology and Pharmacovigilance (1+1)**

This course introduces the student to the basic principles of clinical research, design of research studies, types of research studies, clinical trials, statistical presentation of research data and ethical guidelines in drug research. 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, analyses, and criticize pharmaco-epidemiological studies. This course also provides the students with understanding of pharmacovigilance importance, concept, processes, systems, global safety standards and regulations and reporting systems.

### **MS 102 Mathematics (1+0)**

Functions and graphs, limits and continuity, differentiation, exponential, logarithmic, and trigonometric functions, integration, basic differential equations, functions of several variables and problems related to them, probability and random variables, and hypothesis testing.

### **NP 101 Information Technology (1+1)**

This course tends to provide students of all university's faculties with a brief introduction to the world of computers and the concept of information technology including: number systems and data representation, computer system components: hardware & software, storage and input/output systems, Operating systems and Utility Systems, software applications. Also, it gives an overview about computer networks and internet: data communication, transmission modes, transmission media, computer networks, internet protocol, and internet services. It practices some computer applications in the laboratory such as Internet Access, word processing and power point. It gives students a practical experience on developing projects related to the specialty of each faculty.

### **NP 102 Human Rights and Fighting Corruption (1+0)**

يغطي هذا المقرر الموضوعات التالية: حقوق الانسان في القانون الجنائي، حق الانسان في تغيير جنسيته او التخلي عن احدي جنسياته، المواثيق الدولية المتعلقة بحماية حقوق الانسان، علاقة العولمة و التنمية بالحقوق الاقتصادية و الاجتماعية و الثقافية، الحقوق الاقتصادية و الاجتماعية و الثقافية للانسان، حقوق الانسان في الشريعة الاسلامية، حقوق المرأة في قانوني العمل و التأمين الاجتماعي، حقوق الانسان في التقاضي، الحقوق المدنية و السياسية للانسان.

### **NP 303 Scientific Writing (1+1)**

This course is designed to introduce students to the principles of good scientific writing, to be familiar with basic structure of scientific reports and research articles. It covers methods of paraphrasing, common mistakes in scientific writing, different writing styles, how to write a scientific report, proposal and manuscript, appropriate use of tables and figures in data presentation and evaluation of literature and information sources.

### **NP 404 Communication skills (0+1)**

The course will help students develop necessary written and oral communication and presentation skills to improve inter- and intra-professional collaboration and communication with patients and other health care providers.

### **NP 705 Pharmaceutical Legislations and Regulatory Affairs (1+0)**

A detailed presentation of law that governs and affects the practice of pharmacy, legal principles for non-controlled and controlled prescriptions, OTC drug requirements, opening new pharmacies, opening medical stores, opening factories, opening scientific offices, medicine registration, pharmacies

and medicine stores management. Pharmacist duties and responsibilities, pharmacist-patient relationship, patient's rights and ethical principles and moral rules.

### **NP 906 Marketing and Pharmacoeconomics (2+0)**

Pharmacoeconomics: The basic concepts of health economics, learning basic terms of health economics and understand key principles. Topics cover the economic mechanisms of health care markets as market failures, and government intervention. The course covers the key components of health care financing, and some methods of how to contain health care expenditure. Alongside the major definitions in health technology assessment, students should have an overview about different types of economic evaluation, budget impact analysis and their uses. Moreover, students should get familiar with different methods of pricing among which value-based pricing. Marketing: The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in assessing and solving marketing problems. The course is also a foundation for advanced electives in Marketing as well as other business/social disciplines. Topics include marketing strategy, customer behavior, segmentation, market research, product management, pricing, promotion, sales force management and competitive analysis.

### **NP 007 Entrepreneurship (1+1)**

This course is designed to enhance a student's knowledge in leadership, business, and financial skills in pharmacy practice while learning the traits of an entrepreneur, current topics in entrepreneurship with a specific focus on pharmacy practice and patient care programs. This course will teach the participants a comprehensive set of critical skills needed to develop a profitable business project. This course is designed to provide the students the personal and business tools including risk-taking, strategic planning, marketing, competitiveness, and social responsibility to make the transition from the academic environment to the daily practice of pharmacy now and in the future, with an emphasis on entrepreneurship.

### **NP 008 Professional Ethics (1+0)**

Professional ethics provides general principles and history of pharmacy ethics, general principles of medical ethics, conflicts of interests and its management pharmacist's relationship with society and family, ethics in disaster, medication error, research ethics and animal ethics.

### **PC E12 Advanced Pharmaceutical Analysis-Spectroscopy (1+1)**

Applications of instrumental methods of analysis (ultraviolet and infrared spectroscopy; NMR; mass spectrometry; atomic absorption spectroscopy) to pharmaceutical compounds.

### **PG E08 Alternative Medicinal Therapies (1+1)**

Widely used OTC herbal preparations, nutritional supplements, and homeopathies, food items for health promotion purposes (prevention/treatment of diseases) as well as selection of useful and safe products: role of pharmacist in patient counseling.

### **PG E09 Productions and Manufacture of Medicinal Plants (1+1)**

Commercial production of medicinal plants: cultivation, collection, drying, preservation, extraction, quality control, and final packaging of entire or powdered forms or extracts.

### **PG E10 Chromatography and Separation Techniques (1+1)**

Introduction and modes of separation, gel filtration and permeation, ion exchange chromatography, type properties, ion exchange and non-ion exchange manifestation and applications. High-pressure liquid chromatography, gas liquid chromatography and their applications.

### **PT E12 Quality Assurances and GMP (1+1)**

Quality control and assurance organization, analytical control, inspection control, documentation, environmental control, GMP regulations, and statistical quality control.

### **PT E13 Applied Industrial Pharmacy (1+1)**

Good manufacturing practice regulations and quality assurance with emphasis on process validation and sampling techniques.

### **PT E14 Cosmetic Preparations (1+1)**

Definition and concepts, classification, hair, bath, fragrance, and make-up preparations, nail lacquers, shaving and after-shave preparations, skin care, anal hygiene products, anti-perspirants and deodorants, quality control tests and evaluation of cosmetic products.

### **PB E05 Clinical Nutrition (1+1)**

Kinds and amounts of macronutrients (carbohydrates, fats, and proteins) and micronutrients (vitamins and minerals) that are needed to maintain optimal health and prevent chronic disease in adults.

### **PO E07 Biological Standardization (1+1)**

Introduction to concepts of screening and bioassay in the course of drug discovery. Testing for drug activities belonging to the following drug classes: central and autonomic nervous systems, cardiovascular system, hormones, analgesics, and anti-inflammatory drugs.

**PO E08 Veterinary Pharmacology (1+1)**

Commonly used veterinary biological and pharmaceutical preparations, general sanitary and management procedures for the prevention and control of livestock diseases, brief review of infectious diseases and animal parasites.

**PM E07 Gene Regulation and Epigenetics (1+1)**

Introduction to and definition of epigenetic control of gene expression, and its importance in normal development. Epigenetic Modifications and Organization of the Nucleus. Genomic Imprinting and Epigenetic Reprogramming. The Influence of the Environment on Epigenetic Control. Mechanisms of Environmental Influence on Epigenetic Control and Transgenerational Epigenetic Inheritance Through the Gametes. Cancer Epigenetics.

**PM E08 Antimicrobial Stewardship (1+1)**

Introduction to the threat of antimicrobial resistance and how best to tackle it, burden of antimicrobial resistance and the importance of microbiology investigations in antibiotic therapy, antibiotic misuse and overuse as a driver of antimicrobial resistance and how to develop antibiotic guidelines. Evaluation of the strategies that have been implemented in hospitals and make more effective use of antimicrobials.

**PM E09 Infection Control (1+1)**

Course includes the impact of community-acquired and healthcare-associated infections, infection prevention and control practices, the chain of infection, standard and transmission-based precautions, barriers and use of personal protective equipment (PPE), and strategies for preventing the spread of infectious disease to healthcare workers and patients.

**PM E10 Bioinformatics (1+1)**

Introduction to bioinformatics concepts and practice. Biological databases, sequence alignment, gene and protein structure prediction, molecular phylogenetics, genomics and proteomics. Students will gain practical experience with bioinformatics tools and develop basic skills in the collection and presentation of bioinformatics data, as well as the rudiments of programming in a scripting language.

**HM 001 Russian Language 1 (2+0)**

Russian alphabet: vowel and consonant sounds; the intonation of sentences; Personal pronouns; the gender of nouns; numerals (0-40); possessive pronouns; the plural of nouns; simple and compound sentences; Russian etiquette; Russian proverbs and sayings.

### **HM 002 Russian Language 2 (2+0)**

The Adjective; ordinal numerals; names of the days; present tense of the verb; the adverb; the imperative; uses of the Prepositional to denote place and time; use of Accusative to denote the object of action and the day of the week; use of Genitive pronouns with a preposition "Y"; use of the Genitive with the words denoting a quantity; numerals (50-1000).

### **HM 003 English Language (2+0)**

Students learn basics of writing and how writing is evaluated. texts about pharmaceutical issues as "patient safety, effective communication with patients, safety culture.....etc.". Students translate parts of the texts above and others. Pharmaceutical idioms and abbreviations. Linguistics: Grammar, Phrasal verbs and Prepositions. How to express different life situations as " regret, request, apology, offer, suggestion, permission ...etc.