



Faculty of -Philadelphia University
Course Description
Undergraduate Pharmacy Program- Study Plan 2022-2023

(0216122) Mathematics and biostatistics (3 Credit hours)

This course introduces the fundamental principles of mathematics and biostatistics relevant for pharmacy students including numbers, algebraic manipulations, measurements and calculation, functions and sequences, logarithms (Semilog and Log-Log Plots) in addition to descriptive Statistics, graphical descriptions of data, probability principles, discrete random variables, continuous random variables and inferential statistics.

(0216145) General Chemistry for Health Science (3 Credit hours)

This course introduces the fundamental principles of chemistry and it covers the following topics: nature of matter, atomic structure, stoichiometry, reactions in aqueous medium, chemical bonds, gases, liquids, solids and solutions, thermochemistry, chemical equilibria, acids and bases, and chemical kinetics

(0216155) Biology for Health Science students (3 Credit hours)

This course involves studying the basic principles of biology including, structure and function of cells, membranes, energy flow, molecular basis of DNA, and animal anatomy and physiology with emphases on circulatory, respiratory, defines and nervous system.

(0510120) Pharmaceutical Organic Chemistry (1) (3 Credit hours)

Prerequisite (0212109)

This course provides students with the basic knowledge of hydrocarbons (alkanes, alkenes and alkynes) and alkyl halides in addition to stereochemistry including nomenclature, properties, preparation and reactions. Particular emphasis is given on the mechanisms of addition, substitution and elimination reactions.

(0521122) Anatomy and Physiology (1) (3 Credit hours)

Prerequisite (0240110)

This course covers the anatomy and the importance of homeostasis in achieving normal functions of the human body. The course provides the students with knowledge about functions of blood, neuronal cell, peripheral nervous system, muscles (skeletal, smooth and cardiac), gastrointestinal system, liver, renal system and fluid balance. Furthermore, the students are exposed to short review of anatomical and histological characters of particular importance to the above mentioned functions.

(0521123) Pharmaceutical analytical Chemistry (2 Credit hours)

Prerequisite (0212109)

Stoichiometric calculations, principles of chemical equilibria, titrimetric and gravimetric analysis including: aqueous and non-aqueous acid-base titrations, precipitation titrations, complexometric titrations, oxidation reduction and potentiometric titrations and ion-selective electrodes, and principles of gravimetric.

(0510123) Pharmaceutical Analytical Chemistry-Lab (1 Credit hour)

Co-requisite (0521123)

Laboratory sessions of this course explore the analysis of artificial samples and some pharmaceutical products using aqueous and non-aqueous titrimetric methods (acid-base, precipitation, redox and complex formation reactions), gravimetric methods and potentiometric methods.

(0521211) Pharmaceutical Organic Chemistry (2) (2Credit hours)**Prerequisite (0510120)**

This course is a continuation of pharmaceutical organic chemistry (I). It includes the study of the physical properties, nomenclature, preparation methods, identification methods and reactions of the cyclic and acyclic organic compounds: aromatic compounds, alcohols and phenols, ethers, thiols and sulfides, aldehydes, ketones, carboxylic acids and their derivatives and amines.

(0510205) Pharmaceutical Organic Chemistry – Lab (1 Credit hour)**Co-requisite (0521211)**

The course is an introduction to the practical methods used in separation, purification and identification of organic compounds such as melting point determination, distillation, extraction, crystallization, and chromatography.. **As well as some qualitative identification test.**

(0510206) Pharmaceutical Instrumental Analysis (3 Credit hours)**Prerequisite (0521123)**

This course is devoted to the exploration of the instrumental methods of analysis used to check the purity of pharmaceutical products and raw materials while validating these methods according to the quality control requirements. These methods include chromatography (liquid and gas) and electrophoresis, molecular and atomic spectroscopy (UV-Visible, IR, NMR, mass spectrometry, atomic absorption and emission), and electrochemical methods of analysis.

(0510207) Pharmaceutical Instrumental Analysis-Lab (1 Credit hour)**Co-requisite (0510206)**

The experiments are designed to explore the analysis of artificial samples and pharmaceutical products using various instrumental techniques of chemical analysis such as molecular spectroscopy (UV-visible, Infrared, NMR, and Mass spectrometry), atomic spectroscopy (Flame photometry), electrochemical methods and chromatographic methods (GC and HPLC) of analysis.

(0521215) Anatomy and Physiology (2) (2 Credit hours)**Prerequisite (0521122)**

This course is designed to provide students with knowledge regarding the anatomy and the functions and physiological mechanisms of different human body systems. It specially, emphasizes the cardiovascular system including pulmonary and systemic circulation, while covering electrical and mechanical properties of the heart and blood pressure. This course also discusses the anatomy and physiology of the respiratory system with particular to use on different lung volumes and capacities, and mechanism of breathing and controlling of blood gases. Furthermore, the anatomy and physiology of the central nervous system (brain and spinal cord) including the relationship and functions of the different parts of the brain are also covered. In addition, the course also broadly covers the endocrine glands and the functions of its hormones, the anatomy and physiology of special senses including the vision, hearing, taste and smell.

(0520224) Physical Pharmacy (3 Credit hours)**Prerequisite (0250109)**

This course is designed to familiarize the students with the basics of physical pharmacy like states of matter, solubility, dissolution, properties of electrolyte and non- electrolyte solutions, diffusion, buffers and isotonic solutions, drug complexation and chemical kinetics. The knowledge gained in the above mentioned topics is important to understand the pharmaceutical dosage forms regarding their physicochemical aspects, simple formulation, and compounding procedures. Detailed examples and applications pertinent to the studied topics are also covered.

(0510220) Pharmaceutical Biochemistry (3 Credit hours)**Prerequisite (0521211)**

This course provides an overview of the biomolecules structure and characteristics, such as carbohydrates, lipids, amino acids, proteins, enzymes and nucleic acids. The course is contextualized based on these biomolecules and their biological functions, in addition to their relationship with the biochemical reactions that occur in the cells to produce and store energy (bioenergetics)

(0510221) Pharmacognosy and Phytochemistry (3 Credit hours)**Prerequisite (0521211)**

The course is designed to provide basic information about pharmacognosy & phytochemistry including some important pharmacognosy-related terminology, nomenclature, taxonomy, monographs, quality control, methods for extraction, plant tissue and cell culture technique, phytochemical characterization, detection of pharmacologically active compounds which are obtained from natural origin (mainly plant origin), such as alkaloids, cardiac glycosides and anthraquinones with special emphasis on those products used in pharmacy as prescription medicines, controlled drugs or over the counter (OTC) drugs.

(0510222) Pharmacognosy and Phytochemistry-Lab (1 Credit hour)**Co-requisite (0510221)**

The course is designed to provide the student with basic laboratory skills regarding pharmacognosy and phytochemistry. Experiments will cover the microscopic examination of the different plant parts, extraction and identification of anthraquinones and cardiac glycosides including detection of alkaloids by several tests. Application of thin-layer chromatography for routine is also covered.

(0520303) Pharmaceutics (1) (3 Credit hours)**Prerequisite (0520224)**

This course provides an introduction about the different types of pharmaceutical dosage forms the course also discusses different aspects for the formulation of solutions and coarse dispersions (suspensions and emulsions) it also provides basic knowledge and understanding of the different types of interfaces, surface tension, interfacial tension, mechanism of adsorption at different interfaces, classification of the surface active agents and their application in pharmacy, along with the basic knowledge of rheology.

(0520300) Pathophysiology (3 Credit hours)**Prerequisite (0521215)**

This course is designed to provide students with knowledge about causes and mechanisms of various diseases from anatomical and physiological perspectives. The course will be contextualized in detail about the root causes and mechanisms of various diseases of different parts and systems of the human body including cellular injury, cellular death, infection, neoplasia, blood, cardiovascular system, respiratory system, gastrointestinal system, liver, endocrine system, renal system, male and female genital system and central nervous system.

(0510310) Pharmaceutical Medicinal Chemistry (1) (3 Credit hours)**Prerequisite (0521211)**

The first part of this course deals with the understanding of molecular dynamics and its correlation with molecular kinetics whether it is observed outside (physical properties) or inside human body (pharmacokinetics) as well as how to correlate those observations with molecular structure. Therefore, it covers structural properties like lipophilicity, acidity, intermolecular interactions respectively. The second part of the course deals with the biotransformation reactions of drug molecular structure inside the human body (drug metabolism reactions). The third part includes applications of the previously discussed principles on drugs affecting cholinergic and adrenergic receptors. Accordingly, intermolecular interactions, mechanism of action, switching receptor on (agonistic) or off (antagonistic), and structure-activity relationships are also discussed.

(0520322) Pharmaceutics (2) (3 Credit hours)**Prerequisite (0520303)**

This course is designed to provide the students with the knowledge and skills, necessary for the dosage forms developing and compounding that are pertinent to topical, transdermal, rectal, vaginal and pulmonary drug delivery. The course covers the formulation of different types of semisolid dosage forms, transdermal patches, pharmaceutical inserts, aerosols, metered dose and dry powder inhalers. General aspects of pharmaceutical products stability and stability testing will be also emphasized.

(0520324) Pharmaceutics - Lab (1 Credit hour)**Co-requisite (0520322)**

In this course, students will be familiarized with the practical applications of the topics taught in the physical pharmacy and pharmaceutics courses. It covers practical aspects of pharmaceutical

measurements, prescription handling and preparation of liquid and semi solid dosage forms. The covered topics also include practical aspects and data analysis and interpretation of: drug solubility enhancement, rate and order of reactions, effect of temperature on reaction rate, surface tension and critical micelle concentration, and distribution phenomena.

(0521314) Pharmacology (1) (3 Credit hours)

Prerequisite (0520300)

This course is designed to provide students with the basic principles of the science of pharmacology and familiarizes them with the necessary terminology. This course is contextualized based on reflective, interactive and analytical learning. It deals with the concepts of drug receptor interaction, mechanism of action of drugs, adverse effects, dose-response relationship, drug toxicity, drug absorption, distribution, protein binding, metabolism and excretion. It also covers the detailed information about drugs acting on the autonomic nervous system (adrenergic and cholinergic) as well as drugs acting on central nervous system including the histaminergic and serotonergic drugs with special emphasis on drug abuse.

(0520301) Microbiology and Immunology (3 Credit hours)

Prerequisite (0510220)

The course covers the morphology of microorganisms (size, shape, staining reaction and structure), physiology (reproduction, growth, nutrition, cultivation, metabolism), physical factors affecting growth, host parasite relationship, virulence factors, disease development and host response to microbial invasion, and mechanisms of resistance. Relevant groups of microorganisms i.e. bacteria, fungi, viruses and parasites are considered. The course also provide knowledge on immunity to microbial infections, the principles of innate immunity (phagocytosis, complement system, interferon), adaptive immunity (passive and active immunity) along with cell-mediated and humoral immune responses.

(0520302) Microbiology and Immunology - Lab (1 Credit hour)

requisite (0520301)

This course provides a practice using the microscope for observing, identification and isolation of different types of microorganisms (Bacteria, fungi, protozoa). In this course the students are introduced to the physical and chemical methods used for sterilization and disinfection. This course also provides the practical methods in the identification of different pathogens, and the antimicrobial sensitivity test.

(0521321) Pharmaceutical Medicinal Chemistry (2) (2 Credit hours)

Prerequisite: (0510310)

The course describes the structural properties, mechanism of action, structure activity relationships and toxicity of different class of drugs such as β -lactam antibiotics, sulfonamides, tetracyclines, aminoglycosides, quinolones, chloramphenicol, antiviral agents, and antifungal agents, anti-tuberculosis agents with special emphasis on the pharmacokinetic and Pharmacodynamic properties of these drugs.

(0520430) Cosmetics (2 Credit hours)

Prerequisite (0520322)

This course provides an introduction to the knowledge of cosmetic products. In this course, students will learn the anatomy of the skin, hair and dental system, their functions, and relevant care preparations. Furthermore, students will study the most effective cosmetic active ingredients and their medical effects on skin and hair. Also, students will recognize the inactive ingredients for the preparation of cosmetic formulations. Moreover, students will learn the most important regulations for cosmetic products.

(0521323) Pharmacology (2) (3 Credit hours)

Prerequisite (0521314)

This course deals with the study mechanism of action of drugs, pharmacokinetic, adverse effects, clinical applications, drug- drug interaction, and toxicity of drugs act on the endocrine systems and digestive system: such as anti-peptic ulcer agents, antiemetic agents, laxatives, antidiarrheal drugs, drugs used in gastroesophageal reflux and drugs used in inflammatory bowel disease. It also covers the nonsteroidal anti-inflammatory drugs and detailed information about the major classes of antibiotics and chemotherapy of bacterial and fungal infections.

(0520325) Pharmaceutical Microbiology (2 Credit hours)

Prerequisite (0520301)

The course covers the anatomy and physiology of some microorganisms likely to be of importance to the applied field of pharmacy, the principles of microbial pathogenicity and epidemiology, factors affecting growth, control of microbial growth, and recombinant DNA technology. There is a special emphasis on the microbial aspects of pharmaceutical processing, sterilization control, sterility assurance and sterile pharmaceutical products. In addition, this course also provides detailed study on antimicrobial agents (types and mode of action of antibiotics and synthetic antimicrobial agents), clinical uses of antimicrobial drugs, bacterial resistance to antibiotics, chemical disinfectants, antiseptics and preservatives.

(0510415) Clinical Biochemistry (3 Credit hours)

Prerequisite (0510220)

This course discusses the biochemical methods for the diagnosis of different metabolic disorders of human body that occur from different diseases. Topics include the role of plasma enzymes, plasma proteins, carbohydrates, lipids, and hormones in diagnosis, monitoring, and prognosis. Kidney function tests, liver function test and tumor markers are also covered in this course.

(0510416) Clinical Biochemistry - Lab (1 Credit hour)

Co-requisite (0510415)

This course is designed to develop the student's skills in certain essential basic biochemical assays and techniques including spectrophotometric assays, gel filtration, electrophoresis, ELISA, immunoinhibition, and enzyme kinetics. Most of these techniques will be correlated and applied in running clinical biochemical tests for disorders of Iron metabolism, liver disease, myocardial infarction, kidney function, carbohydrate and lipid metabolism>

(0521411) Pharmaceutical Medicinal Chemistry (3) (2 Credit hours)

Prerequisite: (0521321)

The first part of this course deals with drugs used in cancer with main emphasis on alkylating agents, platinum based drugs, antimetabolites, antibiotics, mitotic inhibitors and combination therapy. The second part of the course covers diuretics and respiratory drug development. The last part of the course describes the design and development of cardio vascular drugs that are specially used in the treatment of hypertension such as β -blockers, angiotensin converting enzyme inhibitors (ACEIs), angiotensin-II receptors blockers and calcium channel blockers along with the design and development of gastric proton pump inhibitors. All the above mentioned classes of drugs are contextualized based on their possible mechanism of action, structure activity relationships (SAR), uses, toxicity as well as the factors affecting their pharmacokinetic and pharmacodynamic properties.

(0521412) Pharmaceutical Medicinal Chemistry-Lab (1 Credit hour)

Co-requisite (0521411)

This practical course trains the laboratory skills of two major procedures: the first part includes the assay of marketed drugs (castor oil, Ibuprofen, povidone iodine, ammonium chloride and Rifampicin) by using different analytical methods such as UV, titration, precipitation, chemical reactions to measure the actual drug quantities in a given dosage form and compare that with British and US Pharmacopoeia standards. The second part includes the synthetic procedures where students chemically prepare and purify some of the drugs (such as Aspirin, Benzocaine and Sulfasalazine) by using different purification techniques such as crystallization and extraction.

(0521413) Advanced Pharmacology and Toxicology (3 Credit hours)

Prerequisite (0521323)

This course deals with the study mechanism of action of drugs, pharmacokinetic, adverse effects, clinical applications, drug- drug interaction and toxicity of drugs used for the treatment of various cardiovascular diseases such as antihypertensive drugs, antianginal drugs, antiarrhythmic drugs, drugs used in heart failure as well as diuretic drugs and anti-hyperlipidemic drugs. It also covers detailed information about the major classes of anticancer drugs with special emphasis on the drug-drug interactions. It also provides students with the various aspects of toxicology including the principles of toxicology, general approaches to the management of poisoned patients, the appropriate detoxification methods, toxicological effects of heavy metals, pesticides and household materials. In addition, students study venoms of arachnids, scorpions, and snakes.

(0520420) Industrial Pharmacy (3 Credit hours)**Prerequisite (0520322)**

This course is designed to introduce students to the basic concepts of particle sizing, its importance in pharmaceutical technology and methods used to either achieve that or measure it. Some of pharmaceutical industrial processes will be discussed in details like drying, mixing, clarification and powder flow ability. The course will also provide the students with basic knowledge and understanding of the different machines and techniques, used for the formulation of dosage forms. The course emphasizes the link between basic scientific background and the pharmaceutical industry.

(0520515) Pharmaceutical Communication Skills (1 Credit hour)**Prerequisite (0521314)**

This course emphasizes the value of interpersonal communication as an essential element in building trust between patients and the pharmacy community. The following topics will be discussed: patient-centered communication in pharmacy practice, principles and elements of interpersonal communication, nonverbal communications, barriers to communication, listening and empathic responding to patients, helping patients manage therapeutic regimens, medication safety and communication skills, and ethical behavior when communicating with patients.

(0521416) Over-the- Counter (OTC) Medications (1 Credit hour)**Prerequisite (0521323)**

This course is intended toward exposing students to multiple aspects of the profession of pharmacy at the community setting. Emphasis is placed on developing and reinforcing patient-centered care, clinical decision-making skills and diagnosis of minor diseases that are treated with non-prescription or over-the-counter medications. As well as, preparing students to differentiate patients who need referral for further medical attention. The course introduces students to patient-centered care, and patient self-care concepts. Moreover, OTC drugs will be discussed according to the disease conditions affecting different human system; starting from respiratory system then ophthalmology, external ear, the central nervous system, women's health, gastroenterology, dermatology and pediatrics.

(0521417) Pharmacy Training I (3 Credit hours)**Prerequisite (0521314) and passed 90 credit hours.**

This course introduces students to their professional roles and responsibilities as a pharmacist. The course is intended to provide students with a systematic approach for understanding the basic concept of pharmaceutical care and clinical pharmacy practice and to be familiar with the medical terminology and patient history taking and developing of the basic clinical pharmacy practice skills such as patient counseling, Drug Related Problems, understanding adverse drug reactions and pharmacovigilance system, and understanding drug-drug interactions. This training focus on the cardiovascular diseases, infectious diseases (bacterial, viral and fungal infections).

(0520431) Biopharmaceutics and Pharmacokinetics (3 Credit hours)**Prerequisite (0521323)**

This course is devoted to the exploration and examination of the physical and physicochemical behavior of drugs, dosage forms, and drug delivery systems from the pharmacokinetic view point. Drug absorption processes, bioavailability, and bioequivalence study is also highlighted. This course also introduces pharmacokinetics and pharmacodynamics concepts including absorption kinetics, volume of distribution, and various compartmental models.

(0521422) Clinical Nutrition (1 credit hour)**Prerequisite: (0521416)**

This course focuses on studying various nutritional topics concerned with health and disease and how clinical nutritional care is used to treat several diseases. The course includes the basic principles related to the development of balanced dietary plans, including all nutrients categories and means of administration according to scientific bases and commensurate with the person's condition. The course covers the following topics: the concept of energy balance and obesity, nutrition for diabetic patients, nutrition for cancer patients, nutrition for gastrointestinal tract diseases, liver and pancreas, enteral and parenteral nutrition after gastrointestinal surgical procedures for obese patients.

(0521423) Clinical Pharmacy and Therapeutics (1) (3 Credit hours)**Prerequisite (0521323)**

This course provides an introduction to integrative therapeutic modalities which are used in health care. It focuses on various aspects of clinical therapeutics, where students receive information about important areas in therapeutics including the infectious and respiratory diseases. Various clinical cases of different diseases are also discussed to assess the patient's condition, determine reasonable treatment alternatives as well as to select appropriate therapy (pharmacological and non-pharmacological therapy), including monitoring important parameters to justify those choices. This course also covers various diseases such as upper and lower respiratory infections, upper and lower urinary tract infections, meningitis, tuberculosis, asthma and chronic obstructive airway diseases. The course also covers fungal and viral infections including hepatitis and septic shock.

(0521424) Pharmaceutical Technology (2 Credit hours)

Prerequisite (0520420)

It is a major requirement course which provides a comprehensive understanding of the theory and practice for the production of tablets and capsules. In this course, tablet manufacturing, excipients and quality attributes will be discussed in addition to other related issues along with the detailed explanation on manufacture and formulation of hard and soft gelatin capsules. The course will also briefly discuss modified release technologies in addition to some focus on pharmaceutical preformulation studies.

(0520425) Pharmaceutical Technology – Lab (1 Credit hour)

Co-requisite (0521424)

This course complements the theoretical material of the Industrial Pharmacy and Advanced Pharmaceutical Technology courses. The course is designed to give the students a detailed knowledge concerning powders used in pharmaceutical formulations including powder mixing, milling, and characterization of flowability, compressibility and particle size analysis. Also, the course covers the granulation of powders as one of the main prerequisite steps for tablet compression. Quality control of some solid dosage forms are also covered in the course. The process of Tablet film coating and problems encountered during the process is also included.

(0521426) Pharmacy Practice (1) (1 Credit hour)

Prerequisite (0521323)

The course comprises lecture material and practical training. The lectures will cover the proper customer service, communication skills, directions for memorizing brand names, dosage forms and their strength. These lectures will also cover purchasing, merchandizing and budgeting in addition to marketing tips in community pharmacy. The lectures will also cover patient counseling on the use of antibiotics, anti-hypertensives, hypoglycemic and cardiovascular drugs. The practical training will be carried out in the University's Virtual Pharmacy. This training will focus on how to use the accounting software packages and role-plays covering customer service and proper communication skills according to patient's personality. On the other hand, the training covers wide range of clinical cases, communicating with different patient personalities as well as reading many prescriptions.

(0520514) Pharmaceutical Ethics and Legislations (1 Credit hour)

Prerequisite (0521413)

This course aims at introducing students to the pharmaceutical legislations and laws in Jordan. This course enables students to explore the Laws and Regulations of the Jordanian Pharmaceutical Association (JPA) and realize what rights they have as pharmacists and what duties they have towards patients and society. In addition to that, they will gain the knowledge on registering the pharmaceutical products in Jordan as well as how to ensure the safe and effective delivery of medicines to patients within laws.

(0521511) Phytotherapy (2 Credit hours)

Prerequisite (0521323)

This course builds upon and consolidates the knowledge gained from the courses of pharmacology, phytochemistry, and pharmacognosy. It gives a basic idea about treatment using medicinal plants and natural products from other natural sources; such as animals, algae, and fungi. It includes the definition of phytotherapy, terminology, historical background, available dosage form in the market, toxicity, precaution, regulation, and legislation. The effects of common food ingredients and standardized plant extracts directly pertinent to the pharmacological effects or overall safety of plant-based medicines are also discussed. Scientific evidence ascertaining clinical applications of herbs and natural products in

medicine, from case histories to full clinical trials are also emphasized including herb-herb interaction and herb-drug interaction, and other aspects of the safety of herbal medicines.

(0521512) Clinical Pharmacy and Therapeutics (2) (3 Credit hours)

Prerequisite (0521423)

This course is an expansion of clinical pharmacy and therapeutic(I) and focuses on various aspects of clinical therapeutics. In this course students receive information about important areas in therapeutics including the gastrointestinal, cardiovascular, endocrine systems and skin diseases. Various clinical cases of different diseases are also discussed to assess the patient's condition, determine reasonable treatment alternatives as well as to select appropriate therapy (pharmacological and non-pharmacological) including monitoring the important parameters to justify those choices. The course also covers peptic ulcer disease, constipation, diarrhea gastroesophageal reflux, inflammatory bowel disease, hypertension, angina, myocardial infarction, arrhythmias, dyslipidemia and coagulopathy, besides to the treatment of diabetes mellitus, thyroid disorders, eczema and psoriasis.

(0521513) Pharmacoeconomics (1 Credit hours)

Prerequisite (0521413)

This course is designed to introduce principles and techniques of pharmacoeconomics. It involves evaluation of various analysis techniques usually applied to health sector, with the purpose of evaluating costs and benefits of drugs, medical technologies and health programs. Analysis comprises comparison of the pros and cons of the various options when there is a choice that has to be made; making decisions on the best medicines to use within restricted budgets using multiple types of cost analysis techniques such as: cost-benefit analysis, cost-effective analysis, cost-utility analysis, cost-minimization analysis, and cost-consequence analysis will be discussed. Applications within clinical treatment protocols will be discussed, in addition to drug pricing policies, and controlling drug treatment costs.

(0510513) Pharmaceutical Biotechnology (3 Credit hours)

Prerequisite (0510415)

The course introduces the nucleic acid (DNA and RNA) manipulation and in vitro genes expression to the students. It explains the tools and techniques required for working with nucleic acids as well as for the diagnosis of genetic mutation (genetic diseases). The course also deals with the meaning of biotechnology, various classes of biotechnology products and processes highlighting the modern biotechnology processes. The key process in the technologies of biotechnology like fermentation, upstream and downstream processing, recombinant DNA technology, monoclonal antibody, immunology, cytokines, analysis and verification of proteins, genomics, proteomics, metabolomics are also discussed. In addition to the basics of pharmacokinetics and pharmacodynamics of protein based drugs, this course also covers the formulation aspects as well as the basics of protein and gene therapy.

(0521515) Pharmacy Practice (2) (1 Credit hour)

Prerequisite (0521426)

This course is a continuation of the pharmacy practice (1). In this course lecture material will cover the concepts of Pharmacovigilance, drug information provision, communication skills and customer service. The patient counseling lectures will focus on the use of cosmetics, cold and cough preparations, anti-asthmatics, anti-histamines and gastrointestinal drugs. The proper use of drugs during pregnancy, lactation, as well as for elderly and pediatrics will be also discussed. The practical component should be a continuation of practical training in the pharmacy practice (1) covering prescriptions, communication skills, purchasing and marketing skills. Also, a project pertinent to the field training will be assigned to each student. The University's Virtual Pharmacy will be used for the practical activities.

(0521516)Automation and informatics of health care and pharmacy (1 Credit hour)

Prerequisite (0521413)

This course provides a brief overview of the basic elements of pharmacy and health care informatics and automation including pharmacy and hospital information systems components , medication safety; automated dispensing device; smart infusion pump; big data and its role in patient safety; business intelligence for decision making; pharmacy inventory system and barcode/package process. The student will learn the different technologies in pharmacy department and how to deal with it to improve the workflows, patient safety and revenue of the department. the course will also cover the systems

integration and design to support the daily work and clinical services in the hospital, in addition to the international standards and accreditation for informatics and automation in healthcare system.

(0521517) Pharmacy Training II (3 Credit hours)

Prerequisite (0521417).

This course introduces students to their professional roles and responsibilities as a pharmacist. The course is intended to provide students with a systematic approach for understanding the basic concept of pharmaceutical care and clinical pharmacy practice and to be familiar with the medical terminology and patient history taking and developing of the basic clinical pharmacy practice skills such as patient counselling, drug related problems, understanding adverse drug reactions and pharmacovigilance system, and understanding drug-drug interactions. Identify the sources and collect the essential elements of a pharmaceutical care database, classify drug therapy problems according to their appropriate interventions, and communicate recommendations and plan to patients. This training focus on the vascular disease, endocrine disorders, gastrointestinal diseases, autoimmune diseases, bone and joint diseases, neurological disorders and oncologic disorders.

(0521521) Clinical Pharmacy and Therapeutics (3) (3 Credit hours)

Prerequisite (0521423 and 0521413)

This course is an expansion of clinical pharmacy and therapeutics(1)and (2)and focuses on various aspects of clinical therapeutics. In this course students will receive information about important areas in therapeutics including bone and joint disorders, neurologic diseases and cancer. Various clinical cases of different diseases will be discussed to assess the patient's condition, determine reasonable treatment alternatives as well as to select appropriate therapy (pharmacological and non-pharmacological therapy), including monitoring important parameters to justify those choices. The course also covers osteoporosis, rheumatoid arthritis, gout besides of epilepsy and Parkinson disease, in addition to the treatment of different types of cancer, namely prostate cancer, lung cancer, breast cancer, acute leukemia and lymphomas.

(0521522) Clinical Cases - Lab (1 Credit hour)

Co-requisite (0521521)

This course will cover various clinical case studies of different diseases. In each case, an assessment will be made to a patient's condition regarding the reasonable treatment alternatives, selection of appropriate therapy (pharmacological and non-pharmacological therapy), taking into consideration the cost effectiveness. In addition, treatment plan will also focus on identifying the important monitoring parameters needed to evaluate the patient's care plan. The course also covers diseases such as gastrointestinal tract diseases (peptic ulcer, irritable bowel syndrome), cardiovascular diseases (hypertension, angina and myocardial infarction), respiratory diseases (asthma), upper respiratory tract infections (pharyngitis, otitis media, and sinusitis), lower respiratory tract infections (pneumonia), urinary tract infections, gout, rheumatoid arthritis and osteoporosis.

(0521523) Evidence Based Practice (3 credit hour)

Prerequisite (0521512)

This course is designed to introduce the students to the necessary skills aiming to enable them to translate and apply research findings into the daily patient care practice and clinical decision making. Students learn different study designs, evidence hierarchies, how to formulate a clinical question from its elements (PICOT) (patient or population, intervention, comparison or control, outcome or objective and time frame), how to search through different databases and how to critically appraise the evidence and finally how to apply it on related clinical scenarios.

(0521524) Pharmaceutical Marketing (3 Credit hours)

Prerequisite (0521513)

This course discusses the field of marketing principles in general and its application in the pharmaceutical marketing area with emphasis on the marketing environment, and practices. The course covers the history and development of marketing pharmaceuticals in addition to channel systems, legal requirements, ethics in marketing, budgeting, and product placement. this will help students to prepare for successful careers in the pharmaceutical marketing field. The principles and practical applications of vital elements of pharmaceutical marketing are also discussed with focusing on integrating the theoretical principles with the reality of the pharmaceutical market.

(0520516) Clinical Pharmacokinetics (2 Credit hours)**Prerequisite (0520431)**

This course deals with the drugs absorption, distribution, excretion, metabolism, and pharmacological effects in mammalian systems. It also covers compartmental and physiologically-based pharmacokinetic models as well as non-compartmental approaches. Drug disposition studies in a physiologically realistic context are also covered taking into account the nonlinear events along with the evaluation in biological systems. This course also covers the dose adjustment methods in renal and hepatic diseases.

(0520517) Clinical Applications in Pharmacokinetics – Lab (1 Credit hour)**Co-requisite (0520516)**

This course is a complementary part to the theoretical lectures provided by the co-requisite course (0520516), where the students will gain knowledge of practical techniques used to solve the drug kinetic cases. This course gives an overview of fundamental pharmacokinetic concepts regarding rate and order of processes, parameters usually utilized in classical pharmacokinetic (compartmental), and non-linear pharmacokinetics. In addition, this course highlights in short, some recent models such as physiologic and population kinetics and their mathematical backbone and its relation to logical conclusions of drug time course in the body. During the laboratory sessions/workshops, the student will use plasma concentration raw data to derive the pharmacokinetic models that best describe the process of drug absorption, distribution and elimination, then they will extract specific pharmacokinetic parameters through a number of important practical techniques and also gained experiences regarding calculating and extracting of such parameters. This course also discusses how to use the new pharmacokinetics computer programs, and expose students to applications in a specialized computer laboratory.

(0521527) Regulatory affairs (1 Credit hour)**Prerequisite (0521424)**

This course provides knowledge and practice about regulations and regulatory processes for drugs, in Jordan, USA and Europe. Related activities including regulatory submission and dossier writing will be discussed. A Brief focus on the regulations pertinent to biologics, cosmetics, combination products and medical devices will be presented.

(0521531) Epidemiology and Vaccinations (3 Credit hours)**Prerequisite (0521413)**

The course covers epidemiology, the basic science of public health; it includes the study of the frequency, patterns and causes of infectious diseases in populations. Communicable, non-communicable and contagious infectious diseases and their mode of transmission. Important current topics include emerging and re-emerging infectious diseases, Nosocomial infections, and Bacterial resistance to antibiotics. It also covers the different types of vaccines: which are designed to fight off certain kinds of microorganisms in order to prevent infectious diseases and save lives. Types of vaccines include: Inactivated, Live attenuated, Messenger RNA (mRNA), Subunit, recombinant, polysaccharide, and conjugate, toxoid, viral vector vaccines.

(0521532) Gene Therapy. (3 Credit hours)**Prerequisite (0510513)**

This course provides a fundamental understanding of gene therapy in addition to a deep look at the important trends, research and advances in gene therapy. The students will gain a clear understanding of how gene therapy works, how it has developed and advanced, and how much potential it has. The students will also learn basic principles for getting nucleic acids into cells and using viruses to transfer DNA, proven and new approaches to clinical trials, how to effectively use genome editing tools, methodologies for successful RNAi and expression of non-coding RNAs to regulate genes and treat diseases. The course also covers the basic principles of personalize medicine .

(0521533) Advanced Drug Delivery Systems (3 Credit hours)**Prerequisite (0520420)**

This course provides a comprehensive understanding of biopharmaceutical and physicochemical aspects of dosage form design in an integrative manner, utilizing the amount of knowledge that the student has acquired from the previous relevant courses. In addition, this course also discusses the parenteral, nasal and ocular drug delivery. The fundamentals of pharmaceutical nanotechnology as

drug delivery systems and the basic principles of delivery of biopharmaceuticals, protein and nucleic acids, will also be briefly covered.

(0510525) Pharmaceutical Quality Control and Assurance (3 Credit hours)

Prerequisite (0521424)

This course deals with the quality assurance programs applied in pharmaceutical practice and validation of these programs. This course also discusses the practical experiences in quality control through skills gained in areas such as raw material testing, in-process testing, finished product testing, method and instrumental validation, process validation, drug stability, pharmaceutical statistics, quality control charts, process capability analysis, acceptance sampling plans and cGMP/GLP Compliance. Quality management systems and standards such as TQM, ISO, GMP are also included.

(0520526) Special Topics (3 Credit hours)

Prerequisite (0521423)

This course comprises emerging topics related to pharmaceutical sciences such as pharmacy practice, pharmaceuticals, clinical pharmacy and therapeutics among others. Topics can vary from semester to semester. The course description and syllabus must be prepared and approved by the Faculty Council in the semester preceding that in which the subject matter will be served.

(0510518) Drug Design (3 Credit hours)

Prerequisite (0521411)

This course covers the scientific approach for developing new drug molecules based on studying basic methodology in the pharmaceutical medicinal chemistry and drug design especially by exploring structure activity/toxicity relationships of drugs. A study of the lead molecule and its optimization techniques will be broadly discussed for the design of new chemical entities (NCEs) or to improve the potency of a lead. In particular, the study of receptor-drug and enzyme-drug interactions is extensively covered at the molecular levels emphasizing all the physico-chemical factors affecting the binding of drugs. The course will focus also on the design of DNA intercalating agents and prodrug approaches in drug design. This course also introduces students to use the computational modelling software in studying the crucial interactions observed between the ligand and biological target (receptor/enzyme/nucleic acids) for the prediction of the binding affinity/orientation of the ligand. Finally, various ligand-based and structure-based drug design strategies for virtual screening of novel drugs are also discussed with suitable case studies.