Course Descriptions for the Undergraduate Biochemistry Program 2020

1. University Required Courses

ADM 105 Introduction to Information Technology (3 credits)

This course aims to give the students general knowledge about microcomputers and their applications which can be used later in their field of study. These applications are: word processing, computer presentation, spreadsheet and the Internet/Communication concept.

LIT 105 Arabic Civilization (3 credits)

This course introduces the overall concepts of civilization and the most important factors that contributed to the emergence of Islamic civilization. It also encompasses the main characteristics of the Islamic civilization with particular focus on the human dimension. Manifestations of Islamic civilization in policy, management, economy, society, and sciences are emphasized; topics discussed include: the Caliphate, the Ministry, the Emirate, tax calculations, the judiciary, the mandate of grievances, the police, government bureaus, the treasury, mail department, the army, the navy, women's rights and contributions, intellectual life, sciences, technological manifestations, and others. The impact of Islamic civilization in the European Renaissance and the reasons for the decline of civilization and ways to address them are also discussed.

EDU105 Introduction to Sociology (3 credits)

يتناول المقرر: تعريف علم الاجتماع وعلاقته بغيره من فروع المعرفة ,مفهومه,أهميته, فروعه وأبحاثه. علاقته بالفلسفة والتاريخ والجغرافيا وعلم النفس والاقتصاد والسياسة والقانون والأديان واللغة. المجتمعات والجماعات البشرية, مكونات النظم الاجتماعية, عمليات الضبط الاجتماعي, مفاهيم المراكز والأدوار الاجتماعية, العمليات والمتغيرات الاجتماعية, الظواهر الاجتماعية والمشكلات والعوامل المؤثرة في الظواهر الاجتماعية.

LIT 110 Arabic Language I (3 credits)

The primary aim of this course is to familiarize the students with correct writing styles, to avoid linguistic and spelling errors, to use proper punctuations, and to master various correspondence styles. The course also discusses the main principles of Arabic grammar through selected texts, spelling rules, writing paragraphs about subjects related to the selected texts, summary techniques, punctuations, rules of number spelling, common linguistic errors, titles, Curriculum Vitae editing techniques, methods of writing minutes of meetings, and administrative correspondences.

LIT 120 English Language I (3 credits)

This is a study skills course that aims at developing potential teacher's proficiency in the skills of test taking, studying, word attacking, paraphrasing, restating and handwriting.

2. Faculty and Major Required Courses

PHY101 General Physics (3 credits)

The purpose of this course is to give students, primarily those in the field of computer science and biochemistry, a general overview of mechanics, electricity, electronics, thermodynamics and modern physics, with emphasis on examples and applications in modern technology fields. At the end of this course, the student will have good knowledge of how a scientist or engineer makes use of physics concepts to contribute to technological advancement and impact the society.

MAT105 Linear Algebra for Life Sciences (3 credits)

This course is designed to introduce life science students to the world of linear algebra. It includes topics such as vectors, matrices, determinants, eigenvalues, eigenvectors, systems of linear equations and other related topics.

BIO131 General Biology (3 credits)

General Biology is designed to provide the fundamentals of biological science. This course emphasis and covers the following topics: embryology of the vertebrates and the invertebrates, animal and human development and reproduction, vertebrate physiology and ecology. In addition it covers general chemistry and biochemistry of the cell, cell structure and function, origin and evolution of living things, molecular and organismal genetics. Upon completion, students should be able to demonstrate understanding of life at the molecular and cellular levels as well as developmental and environmental level. This course is intended for students majoring in biology or for non-biology majors who wish to take advanced biology courses.

STAT156 Principles of Biostatistics (2 credits)

Statistics is applied in a wide range of topics in biology. The science of biostatistics encompasses the design of biological experiments, especially in medicine and agriculture; the collection, summarization, and analysis of data from those experiments; and the interpretation of, and inference from, the results. Students will focus in this course on descriptive statistics including sampling, graphical and tabular summary of data, measures of location, measures of variability, regression and correlation, in addition to probability.

BIO160 Cell Biology (3 credits)

This course introduces the student to the cell as a unit of structure of all living organisms. It includes: cell theory, biodiversity and classification of living things, plant cell wall and plasmodesmata and bacterial cell wall, structure and functions of cells and cellular organelles, Cell cycle and mechanism of cell division, cellular respiration and energy transformers, chromatin and DNA structure, function and packaging, cellular junctions. It also includes an introduction to viruses, prokaryotes, protista and fungi.

CHM165 General Chemistry I (3 credits)

This course targets to teach students the basic principles of general chemistry. The course will cover the fundamental aspects of matter and measurements, stoichiometry, and electronic structure of atoms; the periodic table properties, chemical bonding; molecular geometry; intermolecular forces; thermochemistry and gaseous state.

CHM165L General Chemistry I Lab (1 credit)

This laboratory aims to familiarize students with the laboratory environment and to introduce them to the proper and safe way of running an experiment. This course consists a theoretical and an experimental part. Students will be able to know hand skills, to illustrate theory, to promote simple scientific methods of thoughts and to interpret experimental data.

CHM166 General Chemistry II (3 credits)

Students in General Chemistry will gain knowledge and critical thinking skills to further explore their scientific interests. The course study the principles of chemical equilibrium, the rates and mechanisms of chemical reactions. Topics covered in General Chemistry II include

kinetics and equilibria of chemical reactions, acids and bases equilibria and titration, thermodynamics, and nuclear chemistry.

CHM166L General Chemistry II Lab (1 credit)

This practical course includes experiments dealing with the following topics: safety and laboratory rules; chemical observations; stoichiometry; volumetric analysis; oxidation and reduction; colligative properties; thermochemistry, chemical kinetics; equilibrium; electrochemistry; thermodynamics. Students become familiar with the scope, methodology, and application of modern chemistry and to learn to appreciate its ability to explain the physical world. Furthermore they become adept at problem solving by learning to interpret data, to employ valid and efficient methods of analysis, and to assess whether or not the results of calculations are reasonable. Finally they will be able to generalize the analytical and quantitative skills gained in this course and to apply them in more advanced courses and throughout ones career. Laboratory experiments should encourage students to gain manipulative and observational skills, in addition to the ability to interpret experimental data.

CHM203 Inorganic Chemistry (3 credits)

There are some ninety-two naturally occurring elements as well as a handful of man-made radioactive elements. When in combination, these elements constitute all of our food, shelter, energy sources and everything we manufacture and use in our lives. This course provides a foundation for the understanding of the varying chemistries of the elements of the Periodic Table, with emphasis on inorganic materials. The course includes many fundamental topics in inorganic chemistry such as: inorganic nomenclature; electronic structure, periodic trends of elements, atomic orbitals importance for chemical bonding; ionic bonding: lattice energy; covalent bonding: valence bond theory & molecular orbital theory; metal bonding: metals, alloys, semiconductors and insulators; Introduction to coordination compounds; The representative elements and their compounds: Review of the chemical/physical properties of the elements of each group in the periodic table.

CHM203L Inorganic Chemistry Lab (1 credit)

This course is designed to introduce the student to research techniques in inorganic chemistry. The manual of Inorganic laboratory work is a laboratory guideline to the students. According to the material of Inorganic course, the laboratory activities are directed to understand the model of ionic compound close packing, reduction-oxidation reaction of several metals, improve the double salt preparation and re-crystallization skills as the basic for advance laboratory activities. The entrance into these new areas of research requires a greater appreciation of safety hazards related not only to the chemical properties of reactants but also

to the dangers presented by unfamiliar apparatuses. Laboratory experiments should encourage students to gain manipulative and observational skills, in addition to the ability to interpret experimental data.

CHM210 Analytical Chemistry (3 credits)

Analytical Chemistry is targeted at students pursuing higher education in the chemical and biochemical sciences. The goal of this course is for students to master applying concepts and solving problems in analytical chemistry. This course will cover theory and applications of qualitative and quantitative analytical chemistry, with particular emphasis on quantitative chemical analysis.
The students will learn about various processes and measurements involved in a chemical analysis. The topics related to both classic (e.g., titrations) and modern analytical techniques (e.g., separations and spectroscopy) will be covered.

CHM210L Analytical Chemistry Lab (1 credit)

This lab course is designed to provide Chemistry students with the experimental background for understanding the behaviors and properties of aqueous solutions. The analytical chemistry approach encourages students to think and act more independently when separation and identification of various mixtures is discussed. The main goal is to lay the foundation for the students to observe, search for information, analyze and develop their own analytical chemistry projects.

BCH215 Physical Chemistry for Biologists (2 credits)

Consent of instructor and senior standing. Classical and statistical thermodynamics with applications to pure systems, solutions and electrochemistry; transport; chemical and enzyme kinetics, quantum chemistry of structure and chemical bond; and spectroscopy all with emphasis on biological applications.

BIO230 General Microbiology (2 credits)

This course explores the biology of microorganisms whether they are unicellular, multi cellular, or even acellular. Major areas to be covered include microbial cell structure and function, physiology, metabolism, genetics, diversity and ecology. Applied aspects of microbiology will also be covered, such as biotechnology, the role of microorganisms in environmental processes, and medical microbiology. Microbiology is a prerequisite for many subjects such as virology, mycology, parasitology, bacteriology and immunology.

BIO230L General Microbiology Lab (1 credit)

Students in this course will culture microorganisms from natural sources such as their own skin, and learn various methods while studying the organisms they have cultured. The topics for the course include types of methods used to culture and study these microorganisms including aseptic technique; preparation of microbiological culture media; isolation of bacteria from natural sources and cultivation of various types of microbes; use of microscopes and basic staining techniques; and identification of unknown bacterial isolates.
The exercises incorporate practice with (a) data analysis, (b) commonly used computational skills needed by microbiologists, and (c) safety practices for protecting the microbiologist, personnel on whom the laboratory depends, and the workspace from microbial contamination.

BCH240 Biochemistry I (3 credits)

This course explores the basic principles of biochemistry and its role in developing biological networks. Topics cover: Basic knowledge about main biomolecules, amino acids, simple sugars and fatty acids, their structure and how they assemble into macromolecules, building a cell. The course also focuses on understanding biochemical principles with an emphasis on kinetics, thermodynamics, bioenergetics and interaction of biomolecules within the metabolism.

BCH240L Biochemistry I Lab (1 credit)

Biochemistry I Lab is designed to learn students how to distinguish between major biochemical molecules (carbohydrates, lipids, proteins) by using series of specific qualitative tests for this purpose.

CHM246 Organic Chemistry I (2 credits)

The course offers comprehensive understanding of the basic principles of organic chemistry. The course describes chemical bonding, molecular geometry and hybridization, structure properties, nomenclature, synthesis, and reactions of alkanes, cycloalkanes, alkenes, alkynes, alkyl halides, and stereochemistry. Addition, elimination and nucleophilic substitution reactions. Emphasis on the mechanistic, kinetic and thermodynamic aspects governing these reactions.

CHM246L Organic Chemistry I Lab (1 credit)

This laboratory course accompanies **CHM246** and is an introduction to the experimental techniques commonly used in the organic chemistry laboratory. The topics covered emphasize basic laboratory techniques; such as distillation (simple and fractional), crystallization,

extraction (liquid-liquid) and characterization by physical methods such as melting point and more.

CHM250 Organic Chemistry II (3 credits)

This course will teach students advanced organic reactions, syntheses, mechanistic, and structural studies of organic compounds. Topics covered in Organic Chemistry II include alcohols and phenols, ether and epoxides, sulfur analogues (thiols and sulfides), carboxylic acids, carboxylic acid derivatives (acid halide, acid anhydride, ester, amide, nitrile), aldehydes, ketones, amines, and aromatic compounds.

BCH301 Biochemistry of Integrated Systems (2 credits)

This course focuses on inter- and intra-cellular communication, from the generation of signaling molecules through the cellular responses. It teaches concepts central to understanding cell signaling mechanisms. It covers the major signaling pathways and several emerging pathways in human health and diseases. Analysis of protein-protein interaction networks in cellular signal transduction is also emphasized.

BIO300 Transmission Genetics (2 credits)

Basic principles of classical genetics. Meiosis and chromosomal basis of Mendelian inheritance. Linkage, crossing-over and gene mapping. Sex and heredity. The genetic material. Mutations and chromosome aberrations. Pattern of inheritance. Cytoplasmic inheritance. Population genetics.

BIO305 Molecular Biology (3 credits)

An extension and expansion of BCH310 emphasizing the basics of molecular genetic processes in bacteria, plants, and animals. It also includes a study of gene organization and control of gene expression in prokaryotes and eukaryotes, emphasizing applications in modern biotechnology, and the genetic and biochemical techniques involved in manipulating and assaying gene expression.

BIO305L Molecular Biology Lab (1 credit)

Molecular Biology lab applies concepts learned in the Molecular and Cell Biology course to a molecular biology research project. The research project will introduce students to standard genetic and biochemical techniques common in a molecular biology lab, such as DNA extraction, agarose-gel, electrophoresis, DNA profiling and PCR. The project also will provide

students with a hands-on understanding of how modern DNA-sequencing technology, along with bioinformatic tools, can be used to discover genetic differences and understand cellular function.

BCH305 Enzymology (3 credits)

This is a required Biochemistry course on the subject of Enzyme Structure, Function and Mechanism where the topics studied include enzyme active sites and the mechanisms of enzyme action; enzyme kinetics and regulation. Chemical reactions within the cell rarely occur without the presence of a catalyst, known as an enzyme. The focus of this course is enzyme kinetics, the mechanisms of enzyme catalysis, and enzymatic regulation. The course starts with a review of the basic enzymatic concepts. Then, it moves to enzyme kinetics of single substrate reactions, enzyme inhibition and multi-substrate enzyme systems. The course continues with mechanisms of enzyme catalysis, active site studies, and the description of specific well-characterized enzymes. Because many enzymes play key regulatory roles in metabolism, the course concludes with mechanisms of enzyme regulation.

BCH305L Enzymology Lab (1 credit)

Enzymology lab is designed to give students an understanding of procedures for detection and purification of enzymes and quantitative evaluation of the influence of parameters such as concentrations of substrate and enzyme, pH, temperature and inhibitors on enzyme activity.

BCH310 Biochemistry II (3 credits)

This course uses basic knowledge acquired in biochemistry I for further understandment of key metabolic and biochemical concepts and pathways. Topics cover: the body's bioenergetics, key metabolic pathway for glucose, protein and lipid metabolism, glycolysis and Krebs cycle, cellular respiration, protein targeting and urea cycle, oxidation of fatty acid and lipid catabolism, signal transduction pathways. The course also focuses on how the body adjusts to variations in the demand for energy, and the relationship between misregulation of biochemical pathways and metabolic disorders and diseases.

BCH310L Biochemistry II Lab (1 credit)

Biochemistry II Lab is an advanced laboratory course that focuses on techniques for the preparation and quantitative analysis of proteins and other biomolecules presenting students with a broad spectrum of techniques, approaches and concepts of contemporary biochemistry.

BCH316 Applied Biochemistry (2 credits)

This course is designed to teach the principles of analytical methods used in biochemistry. Topics cover basic biochemistry and molecular biology methods for detection, quantification, and characterization of biomolecules: purification of nucleic acids, proteins, carbohydrates and lipids, spectrophotometry, centrifugation and precipitation, chromatography, electrophoresis, western blotting and PCR. The course also focuses on planning experiments and analysis of experimental data.

BIO345 Immunology (3 credits)

The course deals with the physiological functioning of the immune system in states of both health and diseases; malfunctions of the immune system in immunological disorders (autoimmune diseases, hypersensitivities, immune deficiency, transplant rejection); the physical, chemical and physiological characteristics of the components of the immune system in vitro, in situ, and in vivo. This course will focus on the role and component of the immune system, immune response and finally disorders of the immune system. Students are introduced to basic concepts of flow cytometry, which is a new technique currently used in miost immunology laboratories worldwide. we aims at preparing the students for graduate studies if they intend to do so.

BCH390 Graduation project (2 credits)

This course includes the participation in a laboratory or library research project under supervision of a faculty member.

BCH380 Research Methods (2 credits)

Research methods in Sciences is intended to provide students with the opportunity to experience the scientific discovery and design process. Students will have the opportunity to apply scientific knowledge in the context of developing a research project and how to choose the best way to investigate it. Research methods and experimental design will be emphasized, including the search and study of articles from the scientific literature. Each student is expected to design his/her own research project. Laboratory exposure is an additional component of this course. Students present their research in the written form of a scientifically formatted paper.