Bachelor of Science in Life Sciences

Course Descriptions

Cr Hr: 3 Prerequisite: None Co-requisite: BIO 101 L

The course covers major fields and fundamental principles of modern biology and provides a foundation for more in-depth and specialized studies during the following years. The course concentrates on the core concepts of modern biology and provides knowledge about the role of various biological macromolecules in cell physiology; how different types of cells are integrated into multicellular systems; molecular and chromosomal mechanism of heredity.

BIO 101 L General Biology I lab

Credit hours: 1 Prerequisite: None Co-requisite: BIO 101

This course is a hand on course to apply and discover the Basic skills in practical biology.

BIO 112General Biology IICr Hr: 3Prerequisite: BIO 101Co-requisite: BIO 112 L

This is the second module of the general biology introductory course designed for the Life Science Major curriculum. It concentrates on the fundamental aspects of animal physiology with an emphasis on the human body. The course is focused on the evolution, development, structure, function, health and disease of major physiological systems and regulatory mechanisms coordinating their function in the human organism.

BIO 112 LGeneral Biology II labCredit hours: 1Prerequisite: BIO 101 LAn introductory course that helps the students to correlate concepts they learn in class

An introductory course that helps the students to correlate concepts they learn in class with hands on experience for better understanding. This course covers the basic techniques needed for any biologist such as Micropipeeting, DNA extraction, and Electrophoresis.

BIO 223MicrobiologyCr Hr: 3Prerequisite: BIO 112, CHM112Co-requisite: BIO 223 L

The course provides a basic understanding of modern medical microbiology with emphasis on the contribution microorganisms make to human health and welfare and intensive study of the processes by which microorganisms cause human disease, how the pathogens can be recognized (identified) and what steps can be taken for the prevention and treatment of infections. The emphasis will be placed on the development of observational, practical and analytical skills through supervised laboratory work and demonstrations.

BIO 223 LMicrobiology labCredit hours: 1Prerequisite:BIO 112 LCo-requisite: BIO 223

This course will introduce the students to the basic concepts and practical skills in modern Microbiology by studying the general characteristics and identification of microorganisms. The study of the processes by which these microorganisms cause human disease, how these pathogens are identified in the diagnostic laboratory and what steps can be taken for the prevention of these infections. The classification and mechanism of action of major groups of antibiotics will also be covered. There will be emphasis on the development of observational, practical and analytical skills through supervised laboratory work and demonstrations.

BIO 224Human Physiology and AnatomyCr Hr: 3Prerequisite: BIO 112Co-requisite: BIO 224 L

The course covers human anatomy and physiology from a systems-based perspective, stressing the ways in which different physiological systems interact. Emphasis is on understanding the integration of human anatomy through biological function, development, evolutionary history and genetics. Several clinical examples are given to illustrate how human variation, including congenital defects, emerges from the interaction of development, form, and function.

BIO 224 L Human Physiology and Anatomy lab

Credit hours: 1 Prerequisite: BIO 112 L Co-requisite: BIO 224

This course provides a comprehensive study of the anatomy and physiology of the human body. Upon completion, students should be able to demonstrate an in-depth understanding of principles of anatomy and physiology and their interrelationships.

BIO 345Molecular Biology ICr Hr: 3Prerequisite: BIO223Co-requisite: BIO 345 L

As the first module of the Molecular Biology course, BIO 345 concentrates on molecular mechanisms of genetic processes. This module explains how the flow of biological information from DNA to RNA to protein gives rise to the recognizable, inherited attributes of living organisms. It uses seminal experiments to introduce the students to basic classical and molecular genetics, and then expands on these themes to include genetic engineering and genomic approaches to these phenomena.

BIO 345 L Molecular Biology I Lab

Credit hours: 1 Prerequisite: BIO 223 L Co-requisite: BIO 345

Upon completion of the course, students will be familiar with basic molecular biology techniques such as DNA extraction, polymerase chain reaction, Electrophoresis, and ligation and transformation. Also, understand and apply these concepts in real life applications in the field of medicine, agriculture, food, diagnostic, and forensics.

BIO 357Molecular Biology IICr Hr: 3 +1 LabPrerequisite: BIO 345

As the second module of the Molecular Biology course, BIO 357 concentrates on molecular mechanisms of cellular physiology and interactions. This module provides detailed knowledge of the structural organization and differentiation of eukaryotic cells as well as key processes in development that are based on cell-cell communication and cell movement. It introduces fundamental properties of the cytoplasm and the roles of the cytoskeleton in fundamental biological processes, including chromosome separation, cell motility and intracellular transport processes, as well as the evolution, function and biogenesis of cell organelles.

BIO 357 LMolecular Biology II LabCredit hours: 1Prerequisite: BIO 345 LCo-requisite: BIO 357

This course is built on major techniques in molecular biology that students have learned from Bio 345L such as nucleic acid extraction, DNA Quantification and Quality analysis, Polymerase Chain Reaction, gel electrophoresis, and Restriction digestion. These techniques are applied in the areas of Forensic, medicine,

agriculture, food science, diagnostic, and biotechnology.

BIO 346Biochemistry ICr Hr: 3 +1 LabPrerequisite: BIO 224, CHM 212

The two-module Biochemistry course concentrates on the chemical properties of biological macromolecules with particular attention to the relationship between structure and biological function. The first module specifically covers amino acids, the fundamentals of protein structure, the basics of enzyme catalysis and kinetics, lipids, and membrane structures, transport proteins, the physicochemical basis of signal transduction, vitamins and their functional role in the body.

BIO 346 LBiochemistry I LabCredit hours: 1Prerequisite: BIO 223 L & CHM 211 LCo-requisite: BIO 346

This course introduces the students to the basic Biochemical techniques. These include expressing, quantifying, and purifying proteins as well as study enzyme kinetics and amino acid titration.

BIO 358Biochemistry IICr Hr: 3 +1 LabPrerequisite: BIO 346

The second module of the Biochemistry course concentrates on the complexity of metabolic pathways and their regulation. It reviews the inter-linked metabolic processes involved in nutrient handling and homeostasis.

BIO 358 L	Biochemistry II Lab	
Credit hours: 1	Prerequisite: BIO 346 L	Co-requisite: BIO 358

This focus of this course is to provide the students with hands on experience in clinical biochemistry techniques applied to extract, separate, and detect proteins using chromogenic and fluorescence detection. In addition, students will be experience performing Tissue culture and immunohistochemistry techniques.

SCI 321ImmunologyCr Hr: 3Prerequisite: BIO 224

SCI 321 aims to provide students with an understanding of immunology and the immunological basis of some common and well-known diseases. The course will balance basic knowledge of the underlying complexity of the immune system, such as T and B cell receptor genes, the MHC and antigen presentation, with the application of immunological aspects to infectious diseases, cancer, inflammation and autoimmunity.

SCI 322 Cancer Biology

Cr Hr: 3 Prerequisite: BIO 224

This course will introduce the core aspects of cancer biology. Emphasis will be placed on molecular mechanisms of cancer pathophysiology - such as signal transduction, DNA damage and repair and regulation of cell division, death and senescence as well as on system biology, microevolution of tumors, interaction between tumor and organism. Existing and novel strategies of cancer prevention, diagnosis and treatment will be discussed.

SCI 323 Signal Transduction

Cr Hr: 3 Prerequisite: BIO 224

The concept of "signal transduction pathway" is one of the major advancement in our understanding of how living cell – a unit of life – is functioning: how it adapts to changing environment and communicates with neighbours in multicellular organisms. The perspective of "signal transduction" is essential to understand complex biological processes and diseases ranging from memory formation to diabetes and cancer. The course makes sense of the dizzying array of pathways used by the cell to communicate.

BIO 405 Human Genetics Cr Hr: 3 Prerequisite: BIO345

BIO 405 will cover: 1) the genetic and molecular basis of heredity and inherited traits, 2) how genetics and genomics help to understand the human condition, including genetic diseases, cancer, and human evolution, 3) how basic and translational genetics research is leading to improvements to human health, and 4) current ethical discussions related to human genetics.

SCI 325Bioinformatics and Computational GenomicsCr Hr: 3Prerequisite: BIO112, STA211

The course is a combination of lectures and instructor-guided practical sessions. SCI325 will cover: 1) the theoretical basis of various comparative analyses of DNA and protein sequences, 2) how bioinformatics, genetics and genomics help to understand the population and evolutionary processes, 3) how computational genomic analyses generate testable hypotheses, and 4) a role of bioinformatics in conservation biology, current human genetics and medicine.

SCI 326 Virology

Cr Hr: 3 Prerequisite: BIO 223

The course focuses on the principles of virus structure, replication and genetics. It will help the students appreciate the relevance of virology in the modern world, including the fields of vaccines, anti-viral drugs and cancer. Other acellular biological particles like prions are also discussed. The course reflects many recent developments in virology and offers deeper insights into the subject. Newly-discovered and emerging viruses are discussed.

BIO 440 Biotechnology

Cr Hr: 3 Prerequisite: BIO 223, ENV 205

The aim of this course is to provide a basic understanding of modern biotechnology and its applications. This course is focused on the molecular and genetic tools used to analyze and modify organisms to produce desired small molecules and proteins; discuss established and cutting-edge manipulation techniques in the field of synthetic biology. We will also cover the production of biofuels, bioplastics, amino acids, food additives, various bulk chemicals, and biopharmaceuticals.

LSR 302 Research Methodology

Cr Hr: 3 Prerequisite: ENG112

The course aims to provide students with the basic concepts of research, types of research and the research method. The ultimate aim of this course is to equip students with skills on how to formulate a research hypothesis, review literature, design research projects, acquire & analyze data and report the research findings. The students will also be introduced to research writing and ethical issues associated with research.

LSR 421~422 Life Science Research Project I&II

Cr Hr: 6 Prerequisite: LSR 302

The courses represent a two-semester-term individually guided investigation project involving laboratory work and/or computational investigation in some aspect of Biomedical Science. The background, results

and conclusions of the study to be reported in the form of an oral presentation and progress report by the end of Fall semester, and a thesis and final defense at the end of the course.

LSR 423 Integrative Life Science Research Seminar

Cr Hr: 3 Prerequisite: LSR 421

LSR423 course is designed to train students to summarize results obtained during student research project courses, built up scientific hypotheses and discuss their merits in group seminars with an assessment of the subsequent self-directed learning in oral presentations, coursework or undergraduate thesis writing and defence. This course develops transferable skills associated with analysis and presentation of laboratory-based experimental research in Life Sciences in the form of poster and podium presentation.

LST 421 Life Science Special Topics I

Cr Hr: 3 Prerequisite: BIO 346

LST courses introduces special topics relevant to Biomedical Science. The course subjects can be modified according to faculty availability, students' preferences and pathways.

LST 421 Epigenetics

The course will first review recent progress in understanding fundamental epigenetic mechanisms and events controlling normal human development and physiology, such as growth, metabolism and ageing processes together with environmental factors affecting the human epigenome. This will follow with reviews of the recent discovering of epigenetic etiology of some most significant human disorders.

LST 421 Stem Cells & Regenerative medicine

Stem cells are undifferentiated cells of the body that have the ability to differentiate into a variety of cells and tissues. Last two decades have seen unprecedented progress in our understanding of stem cells and exploring their potential to treat a number of medical conditions. This course provides students with the understanding of stem cells, their types and the latest developments in the use of stem cells in studying a number of diseases including diabetes, heart diseases and neuronal disorders.

Chemistry Course Descriptions

CHM 101 General Chemistry I

Cr Hr: 3 Prerequisite: None Co-requisite: CHM 101 L

CHM 101 is the first-semester course of a two semesters General Chemistry sequence for students majoring in science or preparing for entry into health professional programs such as medicine, dentistry, pharmacy and veterinary science. CHM 101 provides a comprehensive introduction to the basic principles of chemistry, including atomic and molecular structure, properties of gases, liquids and solids, and chemical thermodynamics.

CHM 101 L General Chemistry I lab

Cr Hr: 1 Co-requisite: CHM 101

General Chemistry I Lab provides an introduction to the fundamentals of laboratory techniques in chemistry. Students will carry out measurements, prepare solutions, and perform qualitative and quantitative experiments.

CHM 112 General Chemistry II

Cr Hr: 3 Prerequisite: CHM 101 or CHM 102 Co-requisite: CHM 112 L

CHM 112 is the second of a two-semester chemistry course for science majors or those preparing for entry into health professional programs such as medicine, dentistry, pharmacy and veterinary science. CHM 112 builds on fundamental principles mastered in the first semester of the course.

CHM 112 General Chemistry II lab

Cr Hr: 1 Co-requisite: CHM 112 L

The general Chemistry II Lab (CHM 112 L) is designed to support and illustrate chemical concepts studied in the lecture portion of the course, as well as to introduce important laboratory techniques and encourage analytical thinking.

CHM 211 Organic Chemistry I

Cr Hr: 3 Prerequisite: CHM 112 Co-requisite: CHM 211 L

CHM 211 is the first semester of a two semester sequence for science majors and those preparing for entry into health professional programs such as medicine, dentistry, pharmacy and veterinary science. CHM 211 focus on bonding principles, functional groups, isomerism, stereochemistry, nomenclature, synthesis and reactions of alkanes, cycloalkanes, alkenes, alkynes, alcohols, and alkyl halides. Addition, elimination, rearrangement, and substitution mechanisms.

CHM 211 L Organic Chemistry I lab

Cr Hr: 1 Co-requisite: CHM 211

Organic chemistry I Lab provides an introduction to the fundamentals to laboratory techniques in organic chemistry. This lab introduces students to chemical reactions and syntheses of aromatic, carbonyl, and amine compounds.

CHM 212 Organic Chemistry II

Cr Hr: 3 Prerequisite: CHM 211 Co-requisite: CHM 212 L

CHM 212 is a continuation of CHM 211. It covers nomenclature, properties, reactions and synthesis of conjugated dienes, aromatics, organometallics, alcohols, phenols, ethers, aldehydes and ketones,

carboxylic acids and derivatives, and amines. Mechanisms include electrophilic aromatic substitution and nucleophilic addition. Carbohydrates, amino acids, proteins and nucleic acids

CHM 212 L Organic Chemistry II lab

Cr Hr: 1 Co-requisite: CHM 212

Organic chemistry II Lab (CHM 212 L) introduces students to chemical reactions and syntheses of aromatic, carbonyl, and amine compounds. Special topics in carbohydrate, amino acid, and lipid chemistry. Lab work includes simple and multi-step synthesis and spectral identification.

CHM 213 Analytical Chemistry

Cr Hr: 3 Prerequisite: CHM 112

Quantitative Analysis (CHM 213) provides a comprehensive introduction to the fundamental theory and laboratory techniques in analytical chemistry. This includes experimental errors and statistics, data analysis methods, chemical equilibria, titrations, spectrophotometry, and analytical separation methods.

CHM 310 Introduction to Instrumental Analysis

Cr Hr: 3 Prerequisite: CHM 212 Co-requisite: CHM 310 L

Introduction to the theories of analysis by instrumental methods. Basic electronics are applied to chemical measurements. Topics include an introduction to the theory of spectroscopy, ultraviolet, visible, infrared, and others. CHM 310 is an introduction to basic principles and the instrumental design of a variety of analytical techniques, including electrochemical, spectrochemical (molecular and atomic), chromatographical and mass spectrochemical techniques.

CHM 310 L Introduction to Instrumental Analysis lab

Cr Hr: 1 Co-requisite: CHM 310

Introduction to Instrumental Analysis lab (CHM 310 L) will introduce the basic analysis utilizing different instruments such as UV-visible spectrophotometer, IR, NMR, GC, HPLC, Potentiostat, and equipment relevant to the materials of CHM 310 course.

CHM 331 Medicinal Chemistry

Cr Hr: 3 Prerequisite: CHM 212

Medicinal Chemistry (CHM 331) will explore the role of chemistry in the design and action of drugs. Principles of drug discovery, drug development, drug interactions, and the structure-activity relationship of drugs will be discussed. Aspects of biochemistry and physical chemistry will be covered as required to understand the chemistry of drug action and drug metabolism. Selected case studies from the major classes of drugs and literature will be used to illustrate concepts covered in the course.

CHM 332 Environmental Chemistry

Cr Hr: 3 Prerequisite: CHM 112 and CHM 211

The purpose of this course is to gain an understanding of the fundamental chemical and biochemical processes that are occurring in the environment. The course will reflect on major issues in the environment, including atmospheric chemistry, air pollution, climate change, energy, water chemistry and water pollution, toxic heavy metals, organic pollutants such as pesticides, herbicides, insecticides, and waste and recycling.

SCI 310Forensic ScienceCr Hr: 3Prerequisite: ENG112 (or ENG113)

This single-semester elective course is designed to provide students with a foundation in the fundamental principles and concepts of forensic sciences. This course introduces the theory, concepts and practices used in the analysis of physical evidence performed in forensic laboratories, the fundamentals of crime scene investigation, forensic DNA analysis, illicit drugs, and forensic toxicology, hair and textile analysis, firearms and ballistics, and counterfeiting and forgery. In addition, selected case studies in different forensic disciplines will be discussed.

ENV 205 Environmental Science & Sustainability

Cr Hr: 3 Prerequisite: CHM 112

This course is general in nature that provides a general introduction to environmental issues and sustainable development. It surveys the impacts that humans have on the environment such as pollution, climate changes, loss of agricultural land, etc. It reviews the principles of sustainability and their applications to energy, climate change, urban planning, transportation, water use, etc. The course will also address changes and steps that can be made to promote sustainability. Current environmental issues will be discussed to motivate students to be active members of society for enhancing environmental awareness and in taking action to address environmental issues and sustainability in KSA.

ENV 310 Environmental Toxicology

Cr Hr: 3 Prerequisite: ENV 205

Environmental toxicology is an elective course focusing on the study of toxic effects of environmental chemicals on living organisms (including humans). In this course, the basic concepts, methods, and approaches in environmental toxicology will be introduced. Natural and synthetic chemicals commonly encountered in the air, water, and soil will be discussed regarding their occurrence, fate and transport, and toxicological effects on ecological species and humans. Case studies will be used to illustrate the complexity of environmental toxicology issues. New trends in chemical toxicity testing will be discussed. Contaminants of emerging concerns such as pharmaceutical and personal care products and engineered nanomaterials will also be introduced.

ENV 315 Earth Systems Cr Hr: 3 Prerequisite: ENV 205

This course focuses on the profound transformation of Earth's environment that is now apparent, a transformation owing not to the great forces of nature or to extraterrestrial sources but to the numbers and activities of people – the phenomenon of global change. This course sets out what is known about global change and the nature of the Earth System.

ENV 330 Energy & Sustainability Cr Hr: 3 Prerequisite: ENV 205

This course will help students to understand the critical relationships of the environment, energy, and sustainability. Leading experts provide comprehensive coverage of each topic, bringing together diverse subject matter by integrating theory with engaging insights. This course fills an information gap in energy, environment, and sustainability, presenting broad overviews of energy challenges and solutions along with the materials advances needed to enable rapid progress. The purpose of this course is to serve as a college-level that brings together the themes of environment and energy in the context of defining the issues, and subsequently focuses on the materials science and research challenges that need to be met.

ENV 410 Environmental Monitoring

Cr Hr: 3 Prerequisite: CHM 310

This course will cover introduction to environmental science, pollutants including chemical and biological and industrial hygiene. This will includes evaluating the various sampling techniques, pollutants and analytical techniques which can contaminate water, soil/surfaces and outdoor/indoor air. Furthermore, it will emphasize on environmental pollutants detection, hazards controlling, risk reduction, selection of the appropriate instrumentation techniques, calibration, quality control and reporting.

ENV 420 Waste Management

Cr Hr: 3 Prerequisite: ENV 330

This course covers the principles of waste management. It provides an overview of municipal waste, industrial waste, and hazardous waste management including design and economic analysis. Reviews physical, chemical, biological treatment of hazardous waste, and the innovative management practices associated with different waste. Students will be exposed to real world settings through worked examples, case studies, and field trips to water and solid waste management facilities. Case studies for specific industries like petrochemicals, fertilizers, desalination and petroleum refining, etc.

ENV 425 Environmental Policy & Economics

Cr Hr: 3 Prerequisite: ENV 330

This course explores the proper role of government in the regulation of the environment. It will help students develop the tools to estimate the costs and benefits of environmental regulations. These tools will be used to evaluate a series of current policy questions, including: Should air and water pollution regulations be tightened or loosened? What are the costs of climate change in the U.S. and abroad? Is there a "Race to the Bottom" in environmental regulation? What is "sustainable development"? How do environmental problems differ in developing countries? Are we running out of oil and other natural resources? Should we be more energy efficient? To gain real world experience, the course is scheduled to include a visit to the ministries and government institutions in KSA. We will also do an in-class simulation of discussions for and against specific case scenarios.

BSN 430 Nanomaterials & Nanotechnology

Cr Hr: 3 Prerequisite: CHM 310

The course is designed to introduce students to the emerging area of nanomaterials and nanotechnology. The course intends to prepare and train students in the evolving areas of nanoscience and nanotechnology which lies at the interfaces of chemistry, physics, and biology. It will cover the basic fundamentals of Nanoscience and Nanotechnology including properties of nanomaterials, nanoscale phenomena, synthesis and fabrication, and characterization of nanomaterials. In addition, the emerging and potential applications of nanomaterials will be reviewed with more focus on applications related to life sciences.

Mathematics Course Descriptions

CSC 101 Introduction to Computer Science

Cr Hr: 3 Prerequisite: None

This course provides an introduction to a disciplined approach to computer programming and problem solving, utilizing a block-structured high-level language, with an emphasis on procedural abstraction and good programming style. Students will apply programming skills in solving a variety of problems. Algorithmic concepts are also introduced. This course also provides a survey study of data structures and data abstraction, and an introduction to complexity considerations and program verification.

MAT 105 Calculus for Biomedical Sciences I

Cr Hr: 3 Prerequisite: None

This course offers a solid introduction to differential and integral calculus and is designed for students in the biomedical sciences. The course begins with an intensive review of important topics from pre-calculus and an introduction to discrete time and population models. Then it proceeds to cover limits, continuity, differentiation, derivative rules, curve sketching, optimization, difference equations, anti-derivatives, Riemann sums, definite integral, fundamental theorem of calculus, applications of integration.

MAT 116Calculus for Biomedical Science IICr Hr: 3Prerequisite: MAT 105

This course is a continuation of MAT 105. The course covers further integration techniques, such as integration by parts, by substitution and by partial fractions. Other topics include improper integrals, sequences and series, convergence tests, power and Taylor series, solving differential equations, limits and continuity of functions of two variables, partial derivatives, the double integral.

STA 211 Probability and Statistics

Cr Hr: 3 Prerequisite: MAT 116

STA 211 introduces the basics of probability and statistics as used in sciences. It covers introduction to probability, random variables, some common probability distributions, random vectors, sample statistics, regression, and applications in experimental sciences.

Physics Course Descriptions

PHU 205 Mechanics for Life Sciences

Cr Hr: 3 Prerequisite: None

This course is the first of a two-semester sequence that introduces the basic concepts of algebra-based physics. It deals in essence with classical mechanics. The topics covered include particle kinematics and dynamics; conservation of energy and linear momentum; rotational kinematics and angular momentum; simple harmonic motion and fluids.

PHU 205 L Mechanics for Life Sciences

Cr Hr: 1 Co-requisite: PHU 205 (if not completed previously)

This constitutes the laboratory related to the course PHU 205.

PHU 216 Electromagnetism and Optics for Life Sciences

Cr Hr: 3 Prerequisite: PHU 205

The material of the course is Algebra based. The covered material includes the basics of electricity and magnetism, electromagnetic radiation, and optics.

PHU 216 L Electromagnetism and Optics for Life Sciences Labs

Cr Hr: 1 Co-requisite: PHU 216 (if not completed previously)

This material constitutes the laboratory related to the course PHU 216.