COURSE OUTLINE

Biology 101 (C-ID Number: BIOL 190)
General Biology (C-ID Title: Cell and Molecular Biology)

Catalog Statement

BIOL 101 is the first half of a one-year course designed for biological science majors. It covers fundamental biological principles and processes including: the scientific method, biochemistry, metabolism, cell respiration, photosynthesis, molecular biology, cell structure and function, mitosis and meiosis, Mendelian genetics, molecular genetics, and gene regulation.

Total Lecture Units: 3.0
Total Laboratory Units: 1.0
Total Course Units: 4.0

Total Lecture Hours: 48.0
Total Laboratory Hours: 48.0
Total Faculty Contact Hours: 96.0

Prerequisite: CHEM 101

Course Entry Expectations

Prior to enrolling in the course, the student should be able to:

- describe the scientific method and apply it to the development of the science of chemistry;
- describe chemical processes in terms of chemical equations and be able to use the equations to answer quantitative questions concerning the process described;
- analyze modern theories of atomic motion, especially as they apply to gases;
- utilize bonding theories to describe the chemical nature of ions and molecules;
- demonstrate an understanding of intermolecular forces and apply those forces to the nature of solids and liquids;
- demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.

Course Exit Standards

Upon successful completion of the required coursework, the student will be able to:

- identify the properties of lipids, carbohydrates, proteins, and nucleic acids;
- describe the structure of prokaryotic and eukaryotic cells;
- explain cell respiration and photosynthesis;
- describe the relationships between meiosis and Mendelian genetics;
- describe the processes of DNA replication, transcription, and translation;
- explain the basic mechanisms of gene regulation in prokaryotes and eukaryotes.

- demonstrate proper use of laboratory equipment including the microscope, spectrophotometer, and micropipettes;
- demonstrate proficiency with data collection, analysis, and graphical representation.

Course Content **Total Faculty Contact Hours = 96.0**

Introduction **(3 hours)**
- The scientific method and its current application in biology
- Characteristics of living systems
- Overview of evolutionary theory as the central paradigm of the biological sciences

Chemistry of Biological Systems **(6 hours)**
- Properties of water
- Functional groups and carbon based molecules
- Biological monomers and polymers
- Carbohydrates, lipids, proteins, and nucleic acids

Cell Biology **(6 hours)**
- Cell size and surface to volume ratio
- Prokaryotic and eukaryotic cell structure and function
- Cell membrane structure
- Active and passive transport across membranes

Cellular Energetics **(9 hours)**
- Laws of thermodynamics
- Oxidation-reduction and energy
- Phosphorylation
- Cellular respiration
- Energy, pigments, and light
- Light dependent/independent reactions of photosynthesis

Cell Division **(3 hours)**
- Chromosomes, genes, and DNA
- Mitosis
- Meiosis
- Meiotic abnormalities

Mendelian Genetics **(9 hours)**
- Historical perspective of Mendel's work
- Mendelian laws
- Autosomal and sex-linked patterns of inheritance
- Types of dominance
- Recombination and linkage maps
- Solving genetic problems
- Genetic abnormalities

Molecular Genetics **(7 hours)**
- Early work - the search for DNA structure
- Watson and Crick’s model of DNA structure
- DNA replication and repair
- Central dogma of molecular biology
- Mutations - origin and types

Biotechnology techniques

Gene Regulation **(5 hours)**
- Basic prokaryotic models
- Inducible/repressible operons
- Basic eukaryotic models
- Transposable elements

Laboratory Content **(48 hours)**
- Data analysis and graphing
- Microscopy and cell structure
- Diffusion and osmosis
- Enzyme kinetics
- Micropipetting
- Fermentation
- Photosynthesis with spectrophotometry
- Modeling mitosis and meiosis
- Mendelian genetics with statistical analysis
- Bacterial growth and sterile techniques
- Bacterial transformation

Methods of Instruction

The following methods of instruction may be used in this course:
- lectures;
- laboratory demonstrations;
- multi-media;
- online.

Out of Class Assignments

The following out of class assignments may be used in this course:
- written lab reports (e.g. describe results of an enzyme kinetics experiment);
- prepare graphs of experimental results.

Methods of Evaluation

The following methods of evaluation may be used in this course:
- lecture examinations (including multiple choice and essay questions);
- laboratory practical examinations;
- evaluation of written lab reports.

Textbooks

Sadava, David E., et al. *Life: The Science of Biology*. 10th ed. New York: W.H. Freeman, 2014. Print.
13th Grade Textbook Reading Level. ISBN #978-1429298643

Student Learning Outcomes

Upon successful completion of the required coursework, the student will be able to:

- describe and compare the structures of prokaryotic and eukaryotic cells;
- describe, compare, and explain the differences between mitosis and meiosis, and identify cells in different stages of cell division;
- define a gene, explain the processes of transcription and translation, and compare these processes in prokaryotes and eukaryotes;
- explain how organisms acquire energy by photosynthesis and cellular respiration;
- explain the basis principles of Mendelian genetics and solve genetics problems involving autosomal and X-linked genes.