

**J. Sargeant Reynolds Community College  
Course Content Summary**

**Course Prefix and Number:** BIO 250      **Credits:** 3

**Course Title:** Biotechnology Research Methods and Skills

**Course Description:**

Provides students with knowledge and advanced laboratory skills needed for employment in the biotechnology industry. Focuses on use of basic and specialized lab equipment and techniques such as solution chemistry, cell culture, DNA extraction and analysis, and protein extraction and analysis. Emphasis in on lab safety, documentation, quality control, and use of SOPs. Prerequisite: BIO 101 and BIO 147 with a C or higher. Co-requisite: BIO 253. BIO 253 Biotechnology Concepts must be taken prior to or concurrent with enrollment in this course. Lecture 1 hour, Laboratory 6 hours per week. Total 7 hours per week. 3 credits

**General Course Purpose:**

The purpose of this course is to provide students with lab skills to prepare them to pursue entry-level, technical-level, or professional-level careers in biotechnology. This course will focus on providing students with a set of basic biotechnology labs skills such as documentation, quality assurance/quality control (QA/QC) and good laboratory practices (GLPs). Students will learn concepts of experimental design and analysis, cell culture, bio-manufacturing, immunology, protein analysis, DNA techniques, and bioinformatics. Students will learn to select the proper instrumentation and protocols when presented with a research question. This course is designed to serve as the prerequisite to other biotechnology courses in DNA analysis (BIO 251) and protein analysis (BIO 252).

**Course Prerequisites and Co-requisites:**

Prerequisite: BIO 101 and BIO 147 with a C or higher.

Co-requisite: BIO 253. BIO 253 Biotechnology Concepts must be taken prior to or concurrent with enrollment in this course.

**Student Learning Outcomes:**

Upon completing the course, the student will be able to

- Maintain proper documentation of lab protocols and experiments via the use of laboratory notebooks and standard operating procedures (SOPs).
- Use material data safety sheets to identify proper storage, handling, and risks associated with chemicals/chemical compounds.
- Detail the process by which experiments are performed in biotechnology, including the application of the scientific method, experimental design, and data analysis.
- Utilize aseptic techniques when isolating and maintaining cell cultures.
- Make microbiological media.
- Demonstrate proper use of a compound light microscope, including the use and cleaning of the oil immersion lens.
- Perform the calculations for and carry out the execution of solution chemistry in the laboratory.

- Extract and analyze DNA and proteins from cells.
- Describe the process by which potential biotechnology products are investigated.
- Demonstrate proper use of a spectrophotometer.
- Determine the pH of different solutions.
- Grow batch cultures of microorganisms.
- Use dialysis, column chromatography, and HPLC to concentrate and isolate proteins of interest.
- Grow and maintain cell cultures used for biotechnology applications
- Perform techniques used to manipulate and study DNA and Proteins.
- Perform basic immunological assays such as the Enzyme-Linked ImmunoSorbent Assay (ELISA).
- Describe the process of compound identification using GC-MS.
- Interpret the mass spectra of unknown compounds.
- Obtain information on DNA and protein structure and function using web-based bioinformatics resources.
- Describe the difference and impact of Quality Control and Quality Assurance.

### **Major Topics to Be Included:**

- Documentation
- Lab safety
- Experimental design and analysis
- Aseptic technique and cell culture
- Solution preparation and dilution, including media preparation
- DNA extraction and analysis through gel electrophoresis
- Protein isolation and analysis
- Assay development and spectroscopy
- Recombinant protein production (i.e. genetic engineering and cloning)
- Protein product purification and analysis
- Plant breeding and cloning
- Obtaining molecules of pharmaceutical interest
- An introduction to advanced DNA methods (i.e. PCR, DNA sequencing, DNA typing, Southern blots)
- An introduction to advanced protein studies (ELISA and western blots)
- Bioinformatics

**Effective Date/Updated: August 28, 2023**