UTAH SYSTEM OF HIGHER EDUCATION

Utah System of Higher Education
Biotechnology
FY2027 / 28 Credits (900 Clock-Hours)

Foundational Courses

TEBI 1010 Fundamentals of Biotechnology — 3 Credits / 90 Clock-Hours

This Fundamentals of Biotechnology course is an introductory course in the biotechnology program. Students will be introduced to the many fields and applications of biotechnology. Biology and Chemistry fundamentals will be reviewed along with an overview of the central dogma of biology. Other biotechnology topics include recombinant DNA, proteins, bioremediation, and bioethics.

Objectives:
- Describe biology fundamentals, chemistry fundamentals, and their application.
- Identify and define genes, genomes, proteins, and bioremediation.
- Describe and demonstrate the process of recombinant DNA and cloning techniques.
- Identify the different fields of biotechnology, including plant biotechnology and animal biotechnology.
- Perform and record accurate DNA fingerprinting and forensics analysis.
- Identify biotechnology regulations and ethics.

TEBI 1020 Laboratory Safety — 1 Credit / 30 Clock-Hours

This laboratory safety course teaches general laboratory safety, documentation, and signage. Students will learn about personal protection equipment, safe handling of material, safety data sheets, safety regulations, and fire safety. Students will also have the opportunity to certify in AHA CPR, first aid, and bloodborne pathogens.

Objectives:
- Explain the requirements of a safe workplace.
- Demonstrate the proper use of Personal Protective Equipment (PPE).
- Operate the lab using proper laboratory, chemical, and fire safety.
- Demonstrate the safe use and disposal of biological materials.
- Effectively use Safety Data Sheets.
- Define the OSHA and safety regulations.

TEBI 1031 Pipette Validation and Technique — 1 Credit / 30 Clock-Hours

This Pipette Validation and Technique course teaches mastery of the important skills of precision and accuracy in pipette usage. Proper technique is critical to ensure accurate and precise liquid transfer consistently takes place. Students will become proficient in different types and sizes of pipettes and learn proper care and usage.

Objectives:
- Accurately measure liquids using a variety of pipettes and pipetting techniques.
- Demonstrate proper validation and maintenance of pipettes.
- Demonstrate pipetting precision.

TEBI 1040 Aseptic Technique **1 Credit / 30 Clock-Hours**

This Aseptic Technique course teaches a foundation in sterilization and contamination prevention. This focus is important in culturing and isolating organisms and maintaining a sterile lab. Students will understand the basic skills of aseptic techniques found in the biotechnology environment including aseptic handling of products and knowledge of cleaning and disinfection to prevent microbial contamination. Students will become proficient in maintaining a lab to perform contaminate free procedures.

Objectives:
• Demonstrate proper media preparation.
• Create and grow successful cell cultures and use proper isolation methods.
• Demonstrate proper sterilization techniques.
• Practice aseptic techniques in laboratory procedures.

TEBI 1050 Chemical Instrumentation and Laboratory Techniques **3 Credits / 90 Clock-Hours**

This Chemical Instrumentation and Laboratory Techniques course teaches an introduction to the manufacturing of pharmaceuticals and biologicals. This course will allow students to gain practical, hands-on knowledge of the operation, maintenance, and calibration of commonly used and specialized laboratory instrumentation. The students will continue working with good laboratory practices, documentation, and record keeping while discussing regulatory policies and risk management. Students will learn inventory controls, the pharmaceutical/biological approval process, and quality of biotechnological products.

Objectives:
• Practice good laboratory practices.
• Demonstrate proper instrument handling and use.
• Outline the role of various departments in a company, including Research and Development, Quality Assurance, Quality Control, and Manufacturing.
• Describe the roles of the FDA and regulatory agencies.
• Define risk and how it applies to the FDA approval process.

TEBI 1061 Laboratory Calculations **3 Credits / 90 Clock-Hours**

This Laboratory Calculations course teaches how to properly calculate dilutions, volumes, concentrations, and other calculations needed in laboratory work. Students will record and analyze data in proportional relationships through graphing and statistics. Weight, volume, temperature, light, and units involved in different stages of processing; including conversions, will be taught.

Objectives:
• Perform basic math techniques.
• Identify proportional relationships.
• Formulate and interpret equations and graphing.
• Practice and evaluate calculations relating to cell cultures, molecular biology, and PCR.
• Calculate accurate solution concentrations.
• Demonstrate proper use of the metric system.

TEBI 1070 Quality Control and Manufacturing Practices **4 Credits / 120 Clock-Hours**

This Quality Control and Manufacturing Practices course teaches laboratory techs to be efficient and streamline processes found in a biotech laboratory. Students complete the Green Belt Level of Lean Six Sigma in preparation to becoming certified. Students will learn efficiency, waste reduction, process improvement, and current Good Manufacturing Practices that contribute to the quality control in biotechnological manufacturing.

Objectives:
• Describe the components of Lean Six Sigma reproducibility and repeatability.
• Define and describe the 5 Lean Six Sigma phases: design, measure, analyze, improve, and control.
• Develop a real world Lean Six Sigma project.
• Define current Good Manufacturing Practices.

TEBI 1080 DNA Manipulation and Analysis **4 Credits / 120 Clock-Hours**

This DNA Manipulation and Analysis course teaches how DNA structure and synthesis are main processes used for many purposes in biotechnology. Students will separate biologicals through filtration, centrifugation, and bio-separations. Students will analyze DNA sequences, work with transformation and cloning, and use biotechnology processes like polymerase chain reaction and gel electrophoresis.

Objectives:
• Describe DNA structure and analysis.
• Practice proper genomic DNA extraction.
• Demonstrate accurate bio-separations.
• Extract template DNA and design primers.
• Perform proper sequence analysis of individual genomes.
• Practice successful bacterial transformation.
• Perform proper polymerase chain reactions.
• Perform and analyze gel electrophoresis.

TEBI 1090 Protein Purification and Analysis **4 Credits / 120 Clock-Hours**

This Protein Purification and Analysis course teaches students to analyze protein structure, quantitation, purification, and size; along with protein use in biofuels, immunology, and immunoassays. Students will also prepare for the culmination of the program industry exam which covers both knowledge and practical aspects of the biotechnology lab.

Objectives:
• Describe protein structure and analysis.
• Demonstrate proper protein quantitation.
• Demonstrate proper protein purification.
• Practice proper size chromatography.
• Demonstrate accurate vertical electrophoresis.
• Perform accurate immunoassays and immunological applications.
• Complete the BACE test preparation course.

TEBI 1900 Externship **4 Credits / 180 Clock-Hours**

In this Externship course, students will participate in an externship with a local company and apply the academic and technical competencies they have learned in the classroom and lab in a real-world setting. This course is designed to help students transition from being a student to beginning a career as a biotechnician. They will also utilize the employability skills practiced throughout the program.

Objectives:
• Demonstrate the academic and technical competencies of the position.
• Demonstrate safely and competently working in a biosciences job.
• Maintain positive relations with others through teamwork.
• Complete required documentation.