



Course Description

BSC2426L | Biotechnology Methods & Applications 1 Laboratory | 2.00 credits

This laboratory course is designed to complement BSC2426 Biotechnology Methods and Applications 1. This is a hands-on course that emphasizes the basic laboratory principles, techniques, and instrumentation, necessary for effective work in pharmaceutical, biotechnology, and/or research laboratory settings(s). Prerequisite: Previous knowledge of chemistry and biology strongly recommended. Corequisite: BSC2426. Laboratory fee.

Course Competencies

Competency 1: The student will demonstrate knowledge of the basic safety procedures in a biotechnology laboratory by:

1. Describing the elements of a safe laboratory environment
2. Identifying general personal protection regulations and appropriate laboratory attire
3. Describing the location and purpose of safety equipment in the laboratory
4. Demonstrating the safe use of autoclaves and electrical equipment in the laboratory
5. Demonstrating the safe disposal of broken glassware and sharp instruments
6. Identifying the chemical hazards associated with the laboratory
7. Demonstrating the safe use of chemicals in the laboratory
8. Implementing strategies for minimizing exposure to laboratory hazards
9. Demonstrating safe handling and usage of research microorganisms, plants, animals, and their derivatives
10. Describing proper safety measures when working with recombinant DNA
11. Demonstrating proper storage and disposal of hazardous materials and biological specimens
12. Evaluating Material Safety Data Sheets and official regulatory compliance policies
13. Demonstrating proper safety procedures in handling emergency situations and contacting appropriate services and personnel

Competency 2: The student will have knowledge of standard operating and recordkeeping procedures in a biotechnology laboratory by:

1. Describing the principles and rules for quality documentation in the laboratory
2. Identifying procedural forms, protocols, reports, and logbooks in the laboratory
3. Demonstrating accurate collection and recording of laboratory data
4. Maintaining documentation of experimental procedures and results
5. Demonstrating labeling procedures

Competency 3: The student will demonstrate knowledge of the mathematic applications in the biotechnology laboratory by:

1. Listing standard laboratory mathematical equations/calculations
2. Solving equations with different units
3. Solving equations with different ratios and proportions
4. Solving exponential relationships
5. Organizing data visually
6. Analyzing the relationships between data represented graphically or in charts
7. Demonstrating the recognition of the sample's representation and randomness
8. Demonstrating calculations of variance and standard deviation
9. Identifying patterns of normal distribution and standard deviation
10. Solving the percentage of error for particular experiments

Competency 4: The student will demonstrate knowledge concerning the preparation of laboratory solutions in a Biotechnology laboratory by:

1. Demonstrating the calculation of percentage concentrations of solutions

2. Demonstrating the conversion of a standard formulation into amounts of reagent employed in preparing a solution
3. Applying the "X" designation to express diluted solution concentration
4. Determining the amount of a stock reagent of a given concentration needed to obtain the desired final concentration of a solution
5. Summarizing the safety standards for proper storage of laboratory solutions
6. Performing dilutions
7. Demonstrating how to monitor pH in a solution
8. Preparing laboratory solutions for use in experimental procedures

Competency 5: The student will demonstrate knowledge and ability to use and collect data from different kinds of Instruments common for a biotechnology laboratory by:

1. Demonstrating the handling and operation of mechanical and electric balances, pipettes, micropipette devices and volumetric glassware, thermometers, pH meters, spectrophotometers, centrifuges, incubators, laminar flow cabinets, electrophoresis equipment, gel-viewing devices, water baths, microscopes, PCR machines
2. Evaluating technical issues and maintenance associated with laboratory equipment.

Competency 6: The student will gain knowledge of nucleic acid structure, function, and properties by:

1. Explaining: DNA isolation procedures, DNA restriction enzyme treatment, DNA fragments separation utilizing agarose gel electrophoresis, Polymerase Chain Reaction (PCR)
2. Performing DNA isolation procedures, DNA restriction enzyme treatment, DNA fragment separation using agarose gel electrophoresis, PCR
3. Analyzing: DNA isolation procedures, DNA restriction endonuclease treatment, DNA fragment separation using agarose gel electrophoresis, PCR
4. Explaining the resolving power of agarose gel versus polyacrylamide gel electrophoresis for the analysis of DNA
5. Constructing a standard curve for DNA markers migrating during agarose gel electrophoresis and extrapolating the size of an unknown fragment of DNA
6. Constructing a standard curve for DNA markers migrating during agarose gel electrophoresis and extrapolating the size of an unknown fragment of DNA
7. Constructing a standard curve for DNA markers migrating during agarose gel electrophoresis and extrapolating the size of an unknown fragment of DNA
8. Constructing a standard curve for DNA markers migrating during agarose gel electrophoresis and extrapolating the size of an unknown fragment of DNA

Competency 7: The student will demonstrate knowledge of basic separation methods by:

1. Listing parameters for methods of separation, fractionation, and clarification
2. Comparing and contrasting different purification methods
3. Listing the basic principles and types of filtrations and chromatography
4. Explaining basic principles of centrifugation and factors that determine a particle's sedimentation rate
5. Defining differential centrifugation, density centrifugation, and continuous centrifugation
6. Describing fixed angle rotors, horizontal rotors, near vertical and vertical tube rotors, k factors, balancing a rotor, centrifuge, and rotor maintenance

Competency 8: The student will demonstrate knowledge of protein structure, function, isolation, and characterization by:

1. Explaining standard methods used for extraction and purification of proteins
2. Using spectrophotometry as a quantitative method for determining total protein concentration and explaining the chemical reaction responsible for the Bradford Assay
3. Performing protein analysis by polyacrylamide gel electrophoresis

Learning Outcomes:

- Communicate effectively using listening, speaking, reading, and writing skills
- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning