

## **Course Description**

## BSC4422 | Biotechnology Methods and Applications - III | 3.00 credits

This course will explore biotechnology as a science and its implications in modern society. Students will learn how to make well-designed and controlled experiments. Students will also demonstrate knowledge of data acquisition and interpretation. Prerequisites: BSC2427, 2427L, PCB3060, 3060L, BCH3023, 3023L. Corequisites: BSC4422L.

## Course Competencies:

**Competency 1:** The student will demonstrate knowledge of biotechnology as a science and its implications in modern society by:

- 1. Describing how bioscience and biotechnology bring together multidisciplinary capabilities for the study of life processes, living organisms, and human health
- 2. Discussing the specific technologies and capabilities that contribute to biotechnology such as biomedical research and technology, including optics and imaging, sensors, stable isotopes, lasers, biomechanics, robotics, modeling/simulation, computation, and informatics; cellular analysis, including flow cytometry, digital fluorescence microscopy and other Spectro microscopies, cell growth and cell cycle control, DNA damage and repair, cell transformation and carcinogenesis, and transgenic mouse facilities; biomolecular structure, dynamics, and functional analysis, including scanning tunneling and transmission electron microscopy, x-ray and neutron scattering, high-field nuclear magnetic resonance, ultra-fast kinetic techniques, and optical infrared spectroscopies; genome analysis including chromosome sorting, clone libraries, robotics, PCR, genome mapping and sequencing, positional cloning, protein/DNA interactions, modeling and simulation, computing tools, and databases
- 3. Relating the methods and technologies of biotechnology to the numerous social and medical applications, including molecular medicine, a field to which biotechnology logy contributes an understanding of diseases at the molecular level and a rational approach to the design of drugs and other therapies to cure these diseases, involves capabilities in genomics, structural biology, and theoretical and computational biology agricultural and food-producing industries forensic science and practical usage

Competency 2: The student will demonstrate knowledge of the elements of well-designed and controlled experiments by:

- 1. Reviewing concepts such as observation, hypothesis, predictions, experimental design, and conclusion
- 2. Displaying the relationships between assumptions, hypotheses, conclusions, theories, and laws
- 3. Differentiating between experimental, observational, and modeling methods of research
- 4. Interpreting an experiment in which independent and dependent variables can be used to make a prediction
- 5. Identifying methods of using technology in data acquisition, manipulation, and analysis
- 6. Establishing the importance of establishing positive and negative controls in experimental design
- 7. Differentiating between qualitative and quantitative data

**Competency 3:** The student will demonstrate knowledge of data acquisition and interpretation by:

- 1. Critiquing data from published journal articles
- 2. Evaluating data from published journal articles
- 3. Interpreting data from published journal articles
- 4. Recognizing that the validity of scientific knowledge is based on the repeatability of results, statistical significance of results, limitations of current technology, and freedom from bias
- 5. Recognizing that interpretations in science change over time to include novel observations
- 6. Differentiating between basic and applied research
- 7. Designing a controlled research experiment based on information collected
- 8. Preparing a research paper

**Competency 4:** The student will demonstrate knowledge of the impact of biotechnology on society by:

1. Discussing scientific research that may contribute to ethical, legal, and societal conflicts (including but not limited to reproductive and life-sustaining technologies, genetic basis for behavior, population growth and

Updated Fall 2025

control, modern genetic research, the human genome project, and government and business influences on biotechnology)

- 2. Displaying knowledge pertinent to legislation regarding ethical issues in biotechnology
- 3. Identifying state, national, and international codes of ethics and possible consequences for their violation

## Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Demonstrate knowledge of ethical thinking and its application to issues in society
- Describe how natural systems function and recognize the impact of humans on the environment