

Montgomery County Community College
 BIT 123
 Techniques and Instrumentation for Biotechnology
 4-2-3

COURSE DESCRIPTION:

This course will allow students to gain theoretical and practical, hands-on knowledge of the operation, maintenance and calibration of commonly used and specialized laboratory instrumentation. Laboratory procedures will include solution preparation, aseptic technique, protein separations and assays, electrophoresis and recombinant DNA technology. The students will be introduced to the concept of working with good laboratory practices as they pertain to documentation and record keeping. Discussion and implementation of laboratory safety policies will be key components to the entire course. This course is subject to course fee.

REQUISITE(S):

BIT 120 Introduction to Biotechnology,

CHE 131 - Chemistry for Technology I, **or**

CHE 151 - Principles of Chemistry I (For students intending to transfer)

These courses may be taken concurrently **or** may have been taken successfully in a prior semester.

Upon successful completion of this course, the student will be able to:

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHOD
1. Describe laboratory safety practices and implement them when using biological and chemical materials in class activities	Lecture Small Group Discussions Laboratory Experiments Videos Reading - Assignments Guest Lectures	Section Examinations Final Comprehensive Examination Lab exercises and reports
2. Maintain accurate laboratory notebooks and instrument logs.	Lecture Small Group Discussions Laboratory Experiments Case studies Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports
3. Discuss the regulatory agencies involved in the biotechnology industry. Define Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments Case studies	Section Examinations Final Comprehensive Examination

4. Develop a written SOP for a laboratory process or instrument.	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports Written assignment
5. Operate, Calibrate and perform routine maintenance on standard equipment found in a biotechnology laboratory.	Lecture Laboratory Experiments Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports
6. Prepare and standardize various strengths of molar, normal and percent solutions.	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports
7. Perform common laboratory calculations and measurements.	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports
8. Perform recombinant DNA techniques such as restriction enzyme digest, plasmid preparation and PCR	Lecture Laboratory Experiments Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports
9. Describe and demonstrate aseptic techniques as they pertain to microbiological procedures and mammalian cell culture.	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports
10. Define and perform biological separation methods such as chromatography, electrophoresis, filtration and centrifugation.	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments Field Trips	Section Examinations Final Comprehensive Examination Lab exercises and reports
11. Define and distinguish the roles of Quality Control (QC) and Quality Assurance (QA) in a biotechnology	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-	Section Examinations Final Comprehensive Examination Lab exercises and

setting.	Solving Assignments Case Studies	reports
12. Design an experiment to demonstrate the quality control issues in a laboratory setting.	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments	Section Examinations Final Comprehensive Examination Lab exercises and reports
13. Plan and deliver an oral presentation and paper about relevant biotechnology topics	Lecture Small Group Discussions Laboratory Experiments Reading and Problem-Solving Assignments	Student Presentation

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that 70% of students will meet or exceed outcome criteria.

SEQUENCE OF TOPICS:

A. LECTURE

1. Laboratory Safety Procedures (Including Methods, Waste Handling, Identification of Hazardous Conditions and Safety Gear, MSDS)
2. Overview of regulation in the biotechnology industry
3. Quality Control and Quality Assurance
4. Documentation
5. Review of Solution Preparation (Including Chemical Grades, Molar, Normal and Standard Solution Preparation and Calculation)
6. Mathematical Applications Used in Biotechnology
7. Electrochemistry and Measurement of pH
8. Light and Its Measurement (Visible, Ultraviolet and Infrared)
9. Recombinant DNA technology and bacterial transformation
10. Separation methods including centrifugation and filtration
11. Chromatography and Electrophoresis in protein purification
12. Biological Safety levels, Clean rooms and aseptic technique
13. Bioinformatics
14. Student presentations

B. LABORATORY

1. Basic Laboratory Techniques, such as correct use of a micropipette and solution preparation (3-4 experiments)
2. Laboratory Measurements (1 or 2 experiments), including pH and conductivity
3. Equipment Calibration and Recording (1 experiment)

4. UV and Visible Spectrophotometry (2-3 experiments)
5. Quality Control (1 experiment)
6. If Possible, 1 Field Trip to a Biotech (or Related) Company to Acquire Knowledge in Use of Large Scale Instrumentation Not Available on Campus
7. Polymerase Chain Reaction and gel electrophoresis (1 experiment)
8. Aseptic technique as it pertains to microbial experiments and mammalian cell culture (3 experiments)
9. Bacterial Transformation (1 experiment)
10. Isolation of plasmid DNA (1 experiment)
11. Protein separation methods and electrophoresis (1 experiment)
12. Use of Computer Data Handling Systems (1 experiment)

LEARNING MATERIALS:

Seidman, L.A. and Moore, C.J. (2009). *Basic Laboratory Methods for Biotechnology: Textbook and Laboratory Reference* (2nd ed.). Prentice Hall.

Other learning materials may be required and made available directly to the student and/or via the College's Libraries and/or course management system.

COURSE APPROVAL:

Prepared by: Linda R. Rehfuss, Ph.D. Biotechnology Instructor	Date: 11/1/2004
Board of Trustees Presentation	Date: 12/31/2004
VPAA/Provost Compliance Verification:	Date: 7/1/2009
Revised by: Kevin Lampe	Date: 2/2/2010
VPAA/Provost Compliance Verification: Dr. John C. Flynn, Jr.	Date: 6/22/2010
Revised by: Margaret Bryans Ph.D.	Date: 12/22/2012
VPAA/Provost or designee Compliance Verification: Victoria Bastecki-Perez, Ed.D.	Date: 12/2012
Revised by: Margaret Bryans Ph.D.	Date: 11/13/2013
VPAA/Provost or designee Compliance Verification: Victoria Bastecki-Perez, Ed.D.	Date: 11/2013
Revised by: Margaret Bryans Ph.D.	Date: 12/20/17
VPAA/Provost or designee Compliance Verification: Victoria Bastecki-Perez, Ed.D.	Date: 12/2017
Revised by: Margaret Bryans Ph.D.	Date: 11/5/2024
VPAA or designee Compliance Verification:	Date: 11/13/2024

A handwritten signature in cursive script, appearing to read "Chairwoman", is enclosed within a faint, light-colored rectangular border.

This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.