Subject:	BIOL
Course Number:	75
Descriptive Title:	Introduction to Biotechnology
Division:	Natural Sciences
Department:	Biology
Course Disciplines:	Biology, Biotechnology
Catalog Description:	This course features an introduction to the field of biotechnology including a history of its origin and development, scientific principles of biotechnology including biomolecules, cell biology, genetics, physiology, and biological energy, a survey of modern industrial applications and accomplishments, ethical considerations, and career paths.
Prerequisite:	None
Co-requisite:	None
Recommended Preparation:	Beginning algebra or higher or placement by appropriate assessment
Enrollment Limitation:	None
Hours Lecture (per week):	3
Hours Laboratory (per week):	0
Outside Study Hours:	6
Total Course Hours:	54
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Fall 2023
Transfer UC:	Yes
Effective Date:	pending
General Education ECC:	Area 1 - Natural Sciences
Term:	
Other:	
CSU GE:	Area B2 - Physical Universe and its Life Forms: Life Science
Term:	
Other:	
IGETC:	Area 5B - Biological Science
Term:	
Other:	

Student Learning Outcomes:	1. **SLO #1 Knowledge:** Students will be able to demonstrate knowledge of the fundamental biotechnology concepts that include basic molecular biology, industrial applications, a brief history of the field, and ethical considerations. 2. **SLO #2 Scientific Communication:** Demonstrate a proficiency in the techniques used for scientific communication. 3. **SLO #3 Career Proficiency:** Student will demonstrate knowledge necessary to select and develop Science, Technology, Engineering, and Mathematics (STEM) careers.
Course Objectives:	1. Examine the ancient origins of biotechnology. Compare historical origins to recent technological advancements in the field. 2. Analyze the structures of atoms, ions, and isotopes. 3. Distinguish between ionic bonds, covalent bonds, and hydrogen bonds. 4. Examine the structural formula for basic biological molecules. 5. Compare and contrast the morphological differences between prokaryotic and eukaryotic cells. Diagram the distribution and function of organelles found in eukaryotic cells. 6. Diagram a DNA molecule including the backbone and nucleotides. Explain DNA replication and how the genetic material of inheritance is encoded in DNA and expressed through the processes of transcription and translation. 7. Contrast cell reproduction in prokaryotes and eukaryotes. 8. Compare and contrast mitosis and meiosis. 9. Evaluate the molecular aspects of genes and mutation including the patterns of inheritance. 10. Analyze basic human physiology principles including homeostasis, immune and nervous system function, and cellular processes leading to energy production. 11. Compare and contrast conventional production with newer biotechnological-assisted production of medicine, food, and fuels. 12. Assess the environmental impacts of biotechnology. 13. Evaluate a diagnostic test made possible by biotechnology. 14. Analyze the ethical and legal implications surrounding biotechnology.
Major Topics:	**I. Introduction to and History of Biotechnology (1 hour, lecture)** **II. Biomolecules: The Chemistry of Biology (8 hours, lecture)** A. Atoms B. Molecules C. Compounds D. Mechanisms of chemical bond formation E. Bio-molecule structures and features **III. Cell Biology: Prokaryotes and Eukaryotes (9 hours, lecture)** A. Structural differences B. DNA structure C. DNA replication D. Transcription, translation, and the genetic code E. Gene expression differences F. Mitosis and meiosis

	G. Binary fission **IV. Bioinformatics 9 hours, lecture)** A. Introduction to Proteomics B. Introduction to Genomics C. BLAST Analysis D. Sequence Alignment E. PCR Primer Design **V. Basic Physiology (8 hours, lecture)** A. Cell communication B. Immune system **VI. Energy (5 hours, lecture)** A. Photosynthesis B. Cellular respiration and fermentation **VII. Applications of Biotechnology (9 hours, lecture)** A. Medicine B. Drug design C. Diagnostics D. Agriculture E. Environment F. Fuels and energy G. Forensics **VIII. Ethical Considerations of Biotechnology (5 hours, lecture)** A. Environmental B. Drug treatment C. Ecological D. Current issues
Total Lecture Hours:	54
Total Laboratory Hours:	0
Total Hours:	54
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	Complete steps 1-3 beginning with the following DNA code: T C C G C G C A G A G C T A G

1. Use the DNA code to create your mRNA code.
2. Use the mRNA code to create your tRNA code.
3. Use the coding table to determine your amino acids.

Critical Thinking Assignment 1:

In the following human pedigree, the filled symbols represent the affected individuals. You may assume that the disease allele is rare and therefore individuals marrying into the family are unlikely to have defective allele.

- What is the most likely mode of inheritance for this pedigree?
- State the genotypes of individuals #1-5 in the following table using the letter "A". Use the uppercase letter to represent the dominant allele and lowercase letter to represent the recessive allele.

Individual	**Genotype**
#1	
#2	
#3	
#4	
#5	

- If individual #2 and #3 have another son, what are the chances that this son will be affected?

Critical Thinking Assignment 2:

Cystic Fibrosis is autosomal recessive and Huntington's Chorea is autosomal dominant.

- In your own words, explain what *autosomal* means:
  _____
- In your own words, explain what *recessive* means:
  _____
  -
  - If both parents are carriers of Cystic Fibrosis, draw an inheritance pathway (illustrating parents, children, and outcome) to calculate the percent risk that their child will be:
    a. Affected by Cystic Fibrosis: _____%
    b. A carrier of Cystic Fibrosis: _____%
    c. Neither affected or a carrier of Cystic Fibrosis: ____ %

	• In your own words, explain what *dominant* means: _____ a. ○ If the father is affected by Huntington's Chorea (which he inherited from his affected father and unaffected mother) and his wife is unaffected, draw an inheritance pathway (illustrating parents, children, and outcome) to calculate the percent risk that their child will be: b. Affected by Huntington's: _____ % c. A carrier of Huntington's Chorea: _____ % d. Neither affected or a carrier of Huntington's Chorea: ____% e. In your own words, explain why your value for "b" makes sense
Other Evaluation Methods:	Completion, Homework Problems, Matching Items, Multiple Choice, Other Exams, Quizzes, Reading Reports, Term or Other Papers, True/False, Written Homework
If Other:	
Instructional Methods:	Demonstration, Discussion, Field trips, Group Activities, Guest Speakers, Lecture, Multimedia presentations, Role play/simulation
If other:	
Work Outside of Class:	Answer questions, Problem solving activity, Required reading, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Textbooks:	OpenStax. Biology 2nd edition. OpenStax. (February 2022 web update), https://openstax.org/details/books/biology-2e . Licensed under CC by 4.0 Introduction to Biotechnology, 4th edition, Thieman & Palladino, Pearson 2019, ISBN-13: 9780137533220
Alternative Textbooks:	None
Required Supplementary Readings:	None
Other Required Materials:	None
Requisite	
Category	
Requisite course:	None
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	None
Requisite Skill:	None

Requisite Skill and Matching skill(s): Bold the requisite skill(s). if applicable	None
Requisite course:	Taken beginning algebra or be placed into equivalent or higher by assessment.
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	**Using algebraic methods.** Setting up and solving application problems. Identify different types of equations and solve them by applying the appropriate algebraic methods. **Applying graphing techniques.** Graph equations by applying different graphing techniques.
Requisite Skill:	None
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). if applicable	None
Enrollment Limitations and Category:	None
Enrollment Limitations Impact:	None
Course Created by:	Mia Dobbs
Date:	December 7th, 2021
Board Approved:	6/20/2022