Las Positas College
3000 Campus Hill Drive
Livermore, CA 94551-7650
(925) 424-1000
(925) 443-0742 (Fax)

Course Outline for BIO 2A

BIOINFORMATICS

Effective: Spring 2019

I. CATALOG DESCRIPTION:
BIO 2A — BIOINFORMATICS — 4.00 units

Principles of Bioinformatics. Project-based course which will analyze complex biological data. The course introduces students to the tools used for computational exercises relevant to current biotechnologies and computational biology.

3.00 Units Lecture 1.00 Units Lab

Prerequisite
BIO 1C - Cell and Molecular Biology
with a minimum grade of C

CS 7 - Introduction to Computer Programming Concepts
with a minimum grade of C

MATH 40 - Statistics and Probability
with a minimum grade of C

CHEM 1A - General College Chemistry I
with a minimum grade of C

Grading Methods:
Letter Grade

Discipline:
- Biological Sciences

	MIN
Lecture Hours:	54.00
Expected Outside of Class Hours:	108.00
Lab Hours:	54.00
Total Hours:	216.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. BIO1C
1. Identify and explain structure and function of biologically important molecules;
2. Describe cell membrane structure, compare mechanisms of membrane transport, and discuss types of cell junctions;
3. Summarize enzyme structure and relate to function;
4. Identify and explain structure and function of cells and cell organelles;
5. Compare and contrast cellular metabolic pathways
6. Compare and contrast cell communication processes, including cell signaling and signal transduction
7. Explain how DNA replicates and transmits genetic information within organisms.
8. Explain examples of how gene expression is regulated.
9. Apply classical and molecular genetics to solve problems in genetics or biotechnology
10. Explain and apply the major tools and techniques used in biotechnology
11. Apply methods of scientific inquiry and experimental design to the study of biological concepts
12. Perform, document, explain, and interpret a variety of biochemistry, cell, and molecular techniques and experiments.
13. Acquire, read, evaluate, apply, and cite scientific literature
14. Practice scientific writing.

B. CS7
1. Design simple algorithms to solve a variety programming problems.
2. Design and implement programs of short to medium length, using standard elements of programming languages such as variables, input/output, control structures, functions/methods and arrays.

3. Describe the principles of structured and object-oriented programming and be able to describe, design, implement, and test structured and object-oriented programs using currently accepted methodology.
4. Explain what an algorithm is and its importance in computer programming.
5. Design and implement specific program steps and components to achieve desired program behavior.
6. Design and organize elements of a program using a structured representation such as pseudocode and/or flowcharts.
7. Design and implement simple graphical and command line user interfaces implementing the students algorithms.

C. MATH40

D. CHEM1A
1. Solve complex problems involving the concepts listed under course content;
2. Write short explanations describing various chemical phenomena studied;
3. Use standard nomenclature and notation;
4. Describe hybridization, geometry and polarity for molecules and polyatomic ions;
5. Describe bonding in compounds and ions;
6. Describe the nature of solids, liquids, gases and phase changes;
7. Describe metallic bonding and semiconductors;
8. Describe network covalent bonding;
9. Define concentrations of solutions in terms of molarity, molality, normality, percent composition, and ppm;
10. Solve solution stoichiometry problems;
11. Determine the extent of molecular reactions through the study of equilibrium;
12. Utilize library and Internet resources in Chemistry;
13. Collect and analyze scientific data, using statistical and graphical methods;
14. Perform volumetric analyses;
15. Use an atomic absorption spectrometer
16. Acquire and analyze data with a computer and appropriate software.

IV. MEASURABLE OBJECTIVES:

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

A. Assess, use, and interpret data found in various biological databases
1. Apply fundamentals of data management
2. Employ tools used to manipulate data

B. Describe the process of PCR and distinguish between different PCR applications.
1. Explain Next Generation Sequencing and its application in biotechnology.
2. Describe the biological process of Genome Editing and identify current applications.

C. Collect and analyze information through data mining.

D. Explain the study of Proteomics and relate Proteomics to gene expression and regulation

V. CONTENT:

A. Lecture
1. Biological databases
2. Fundamentals of data management
3. Tools used to manipulate data
4. PCR Technology
5. Next Generation Sequencing
6. Genome Editing
7. Bioinformatics applications/data mining
8. Proteomics

B. Laboratory
1. PCR assay design
2. Genome editing
3. Next Generation Sequencing
4. Proteomics

VI. METHODS OF INSTRUCTION:

A. **Classroom Activity** -
B. **Simulations** -
C. **Projects** -
D. **Lecture** -
E. **Lab** -
F. **Audio-visual Activity** -

VII. TYPICAL ASSIGNMENTS:

A. Mining databases
B. PCR Assay design
C. Genome editing design
D. Data analysis of Next Generation Sequencing data

VIII. EVALUATION:

Methods/Frequency

A. Exams/Tests
At least one midterm; and one final exam

B. Quizzes
Minimum of two

C. Research Projects
At least one research project

IX. TYPICAL TEXTS:

1. Momand, Jamil , and Alison McCurdy. *Concepts in Bioinformatics and Genomics.* 1 ed., Oxford University Press, 2016.
2. Lesk, Arthur. *Introduction to Genomics.* 3 ed., Oxford University Press, 2017.
3. Compeau, Phillip, and Pavel Pevzner. *Bioinformatics Algorithms: An Active Learning Approach (Vol. 1).* 2 ed., Active Learning Publishers, 2015.

X. OTHER MATERIALS REQUIRED OF STUDENTS: