

Course Title: Introduction to Python Programming for Biotechnology

Course Description:

This course introduces the fundamentals of Python programming, with a focus on applications in the field of biotechnology. Students will learn the basic concepts of programming, including variables, data types, operators, control flow statements, and functions. They will also gain hands-on experience with various Python libraries and tools commonly used in biotechnology research, such as NumPy, pandas, and Biopython.

Course Objectives:

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

- Write basic Python programs using variables, data types, operators, and control flow statements
- Create and manipulate data structures, such as lists, dictionaries, and tuples
- Define and utilize functions to modularize and reuse code
- Utilize Python libraries for data analysis and visualization, such as NumPy and pandas
- Apply Python programming skills to solve problems in biotechnology research, such as sequence analysis and bioinformatics

Course Prerequisites:

- Familiarity with computers and basic computing concepts
- Basic knowledge of biology and molecular biology

Course Outline:

Module 1: [5L]

Introduction to Python Programming:

- Introduction to Python and its applications in biotechnology
- Setting up the Python programming environment
- Basic syntax and data types (numbers, strings, booleans, etc.)
- Variables and operators
- Input and output operations

Module 2:

[10L]

Control Flow Statements:

- Decision making with if-else statements
- Repetition with loops (for, while)
- Nested control flow structures
- Conditional expressions and Boolean algebra

Functions:

- Defining and calling functions
- Function arguments and parameters
- Return values
- Scope and lifetime of variables
- Built-in functions and modules

List, Tuple, Dictionaries, Sets:

- Lists and their operations (indexing, slicing, iteration)
- Tuples as immutable lists
- Dictionaries and key-value pairs
- Sets and their operations (union, intersection, difference)

Module 3:

[10L]

Data Analysis and Visualization:

- Introduction to NumPy for numerical computing
- Arrays and matrix operations
- Data manipulation and filtering
- Creating visualizations with Matplotlib

Module 4:

[10L]

Python Libraries for Biotechnology:

- Introduction to pandas for data analysis
- DataFrames and their operations

- Reading and manipulating biological data formats
- Introduction to Biopython for bioinformatics
- Sequence analysis and manipulation
- Working with FASTA and GenBank files

Recommended Textbook:

- Python: The Complete Reference by Martin C. Brown
- PYTHON PROGRAMMING 2E by Reema Thareja

Additional Web Resources:

- Official Python documentation: <https://docs.python.org/>
- Learn Python tutorial: <https://www.learnpython.org/>
- Biopython tutorial: <http://biopython.org/DIST/docs/tutorial/Tutorial.pdf>