Miami Dade College

GENERAL INFORMATION	
Course Prefix/Number: CGS1145	Course Title: **Introduction to Bioinformatics**

Number of Credits: 4 credits (3 hr. lecture; 2 hr. lab)	

Degree Type	☐ B.A. ☐ B.S. ☐ B.A.S ☐ A.A. ☒ A.S. ☐ A.A.S. ☐ C.C.C. ☒ A.T.C. ☐ V.C.C

Date Submitted/Revised:	Effective Year/Term: 2007-1

☒ New Course Competency   ☐ Revised Course Competency

Course Description (limit to 50 words or less):

This course introduces the basic concepts and techniques of Bioinformatics. Through research papers, hands-on projects and use of common computational programs, students will apply aspects of Information Technology and Computer Science in order to analyze biological/biomelcular/bioinformatic data. Lab fee. 3 hr. lecture; 2 hr. lab.

Prerequisite(s): BSC-2426 or PCB2061, and either CGS1021 or CGS1060	Corequisite(s):

Competencies:

Competency 1:
The student will explore and explain the evolution and definition of Bioinformatics by:

1. Writing research papers revisiting the basic premises of genomics.
2. Describing at a basic level the Human Genome Project.
3. Accessing and reviewing public websites describing bioinformatics and genomics.
4. Detailing at a theoretical level how computing facilitates the study of molecular and evolutionary biology.
5. Describing the computational techniques by which to convert the mass amount of data from biochemical experiments information.

Competency 2:
The student will explore, via hands-on assignments, the common public genomic tools, programs and databases used for sequence analysis, visualization and predicting protein structures, modeling and mapping by:

1. Exploring and using the basic features of the National Center for Biotechnology Information web site.
2. Exploring and using the basic aspects of the BLAST program.
3. Exploring and using the basic aspects of web-based database, modeling and mapping programs advancing the human genome projects:
   a. GenBank (database)
   b. Protein Data Bank (database)
   c. RasMOL (modeling)
   d. WhatIF (modeling)
   e. MapViewer (mapping)
   f. Primer3 (primers)

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Approved By Academic Dean Date: _____   Reviewed By Director of Academic Programs Date: _____

Competency 3:
The student will demonstrate a practical and topical understanding and use of biomolecular/bioinformatics data by:

1. Downloading, via the internet, representative biomolecular/bioinformatics datasets from public repositories.
2. Storing the datasets in a desktop database.
3. Creating the forms, menus and reports to display and access the data as information.
4. Creating queries to find information, determine patterns, find patterns and display sequences.
5. Generating multi-dimensional depictions and representations of the data for dynamic querying.
6. Composing academic-grade papers describing the informational findings derived from analyzing such data.

Competency 4:
The student will demonstrate an understanding of how to use biomolecular data files directly in the computer's operating system environment by:

1. Obtaining web-based biomolecular data.
2. Editing, merging, and cataloging of the text files.
3. Storing and manipulating biomolecular/bioinformatics text.
4. Creating the processes by which biomolecular/bioinformatic data can be made available via a web portal.
5. Implementing and using security measures in order to control access to sensitive data.

Competency 5:
The student will demonstrate knowledge of the computer's operating system search and substitution methods by:

1. Writing rudimentary scripts.
2. Writing search scripts to match a regular expression against a search.
3. Searching files for patterns.
4. Combining the necessary commands in order to formulate complex searches and pattern substitutions across several biomolecular files.
5. Combining the necessary commands in order to formulate complex regular expressions by which to compare several biomolecular/bioinformatics datasets in order to find patterns across disparate and distributed sequences.

Competency 6:
The student will be able to describe and topically model the essential data structures and associative algorithms of computational biology and computer science by:

1. Defining *lists*, *stacks* and *queues*, and describing their functions.
2. Defining several variants of the *tree* and describing their functions.
3. Defining *hashes* and describing their functions.
4. Defining *heaps* (priority queue) and describing their functions.
5. Describing the steps by which to sort data.
6. Describing the steps by which to merge data.

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Competency 7:
The student will perform data analysis using a desktop database application on biomolecular data by:

1. Using ordering and roll-up techniques to summarize the data.
2. Creating and using data filters.
3. Applying statistical methods to the ordered, summarized and filtered data.
4. Generating of 2, 3 and n-dimensional graphs, charts and pivot tables from the ordered, summarized and filtered data.
5. Transforming the representation of the information into web-usable objects.
6. Writing research papers describing the findings of the data analysis.

Competency 8:
The student will demonstrate the use and interpretation of basic analytics on biomolecular information through the use of a desktop database application by:

1. Drilling-down on pivot tables.
2. Interpreting 2, 3, and n-dimensional graphs and charts.
3. Creating and implementing what-if scenarios.
4. Composing word processing documents that are dynamically linked to pivot tables and charts detailing an analysis of the derived information.
5. Performing basic data mining.
6. Through the use of queries, joins, referential integrity, program functionality and statistical methods, developing a desktop database application by which to dynamically perform the basic data mining.
7. Writing research papers describing the findings of the data analysis.