INSTITUTION National University of Computer & Emerging Sciences, Islamabad

Computer Science (BS) – Fall 2023

PROGRAM (S) TO BE EVALUATED

Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS4054
Course Title	Bioinformatics
Credit Hours	3
Grading	Relative
Prerequisites by Course(s) and Topics	None
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	100% theory Breakdown of Course Work (Total): Midterm 2 30% Quizzes 7 15% Assignments 4 15% Final 1 40%
Course Coordinator	Dr. Hammad Naveed
URL (if any)	
Current Catalog Description	Background and molecular biology primer. Biological databases, genome assembly and sequence alignment. Database searching, clustering and indexing. Protein structure prediction, protein folding, protein networks, molecular dynamics and function annotation.
Textbook (or **Laboratory Manual** for Laboratory Courses)	**Bioinformatics: Sequence and Genome Analysis,** by David W. Mount.
Reference Material	**Computational Molecular Biology An Introduction** by Peter Clote, Rolf Backofen **Bioinformatics: Methods and Applications** by S. C. Rastogi, N. Mendiratta and P. Rastogi, 4th edition, PHI Learning, 2013, ISBN: 978-81-203-4785-4
Course Goals	The course objective is to introduce the broad frontiers of bioinformatics topics from fundamental algorithms to practical tools.

<table>
<tr><td></td><td colspan="4">After completion of the course, the student shall be able to:
1. To learn concepts of genome analysis like assembly and alignment.
2. To learn computer science related concepts used in bioinformatics like clustering and indexing.
3. To learn concepts related to proteomics like structure prediction and folding.
4. To get familiarized with different biological databases.</td></tr>
<tr><td>Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)</td><td colspan="4">● Course Overview 1.5 Lectures
● Background: Molecular Biology 3 Lectures
● Role of computer scientist in Bioinformatics 1.5 Lecture
● Biological Databases 3 Lectures
● Genome Assembly 4.5 Lectures
● Sequence Alignment 5 Lectures
● Database Searching Algorithms 3 Lectures
● Clustering Algorithms 4.5 Lectures
● Indexing Algorithms 3 Lectures
● Introduction to Protein Structure 3 Lectures
● Protein Structure Prediction 3 Lectures
● AI in healthcare applications 3 Lectures
● Statistical tests 3 Lectures</td></tr>
<tr><td>Laboratory Projects/Experiments Done in the Course</td><td colspan="4">None.</td></tr>
<tr><td>Programming Assignments Done in the Course</td><td colspan="4">Indexing algorithms implemented in C++</td></tr>
<tr><td rowspan="2">Class Time Spent on (in credit hours, Hrs/Min)</td><td>Theory</td><td>Problem Analysis</td><td>Solution Design</td><td>Social and Ethical Issues</td></tr>
<tr><td>1.0/60</td><td>1.0/60</td><td>0.9/50</td><td>0.1/10</td></tr>
<tr><td>Oral and Written Communications</td><td colspan="4">Every student is required to submit at least __4__ written reports of typically __5_ pages.</td></tr>
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A. Tentative course outline and lecture plan

Number of Lectures	Topics	Chapter
6	**Introduction:** Introduction to bioinformatics Molecular Biology Primer Role of computer scientist in Bioinformatics	**1, 2**
6	**Biological Databases** Biological databases Searching Algorithms	**10, 3, 7**
10	**Genome Analysis** Genome Assembly Pairwise Sequence Alignment Multiple Sequence Alignment	**3, 4, 8**
8	**Clustering and Indexing** K-means Clustering Hierarchical Clustering Indexing, Hashing	**Additional material will be provide**
6	**Proteomics** Protein Structure Prediction and Folding	**5, 9**
6	**AI in healthcare Applications**	**Additional material will be provide**
3	**Statistical Tests** T-test ANOVA	**Additional material will be provide**