ABDULLAH GÜL UNIVERSITY
GRADUATE SCHOOL OF ENGINEERING & SCIENCE
ELECTRIC and COMPUTER ENGİNEERING PROGRAM
COURSE DESCRIPTION AND SYLLABUS

Course Ttitle	Code	Semester	T+U Hours	Credit	ECTS
BIOINFORMATICS	ECE-561	FALL+SPRING	3 + 0	3	10

Prerequisities and co-re-requisities	Introduction to Computer Programming, Calculus, Probability and Statistics, Linear Algebra

Type	Elective
Language	English
Coordinator	Assist. Prof. Burcu Bakir Gungor
Instructor	Assist. Prof. Burcu Bakir Gungor
Adjunt	None
Aim	This course aims to provide an understanding of: • the types and sources of data available for bioinformatics, • the fundamental computational problems in molecular biology and genomics, • a core set of widely used algorithms in bioinformatics, • a set of algorithms that have important applications in bioinformatics, but which have key applications outside of biology as well.
Learning Outcomes	1. Define the fundamental computational problems in molecular biology and genomics 2. Understand the types and sources of data available for bioinformatics 3. Implement a core set of widely used algorithms in bioinformatics 4. Compare global, local and semi-global pairwise alignments. 5. Compare PAM vs. BLOSSUM scoring matrices. 6. Analyze protein-protein interaction networks. 7. Gain practical experience by applying the techniques on selected bioinformatics problems.
Course Content	• Dynamic programming • Pairwise sequence alignment (Smith-Waterman and Needleman-Wunsch algorithms) • Similarity matrices (PAM and BLOSUM) • Multiple sequence alignment • Analysis of gene expression data (Clustering and classification algorithms) • Methods to analyze large scale biological networks, graphs

WEEKLY TOPICS AND PRELIMINARY STUDY

Week	Topics	Prelimanary Study
1	**Introduction:** Molecular Biology and Computer Science a) The organization of DNA, proteins, cell. b) In silico biology	
2	Pairwise alignment of biomolecular sequences: Global alignment	
3	Local alignment, Semi-global alignment.	
4	Search for similarities: BLAST algorithm	
5	Scoring similarity matrices: PAM and BLOSUM matrices	
6	**Midterm 1**	

7	Multiple sequence alignment a) Iterative Methods b) Structure Based Methods	
8	Scoring multiple alignments	
9	Analysis of high-throughput biological data: Detecting differential gene expression	
10	Multiple hypothesis testing and false-discovery-rate methods for microarray data.	
11	**Midterm 2**	
12	Clustering and classification algorithms for gene expression data.	
13	Protein Folding Problem: Simulated Annealing Algorithm	
14	Protein-protein, protein/DNA interactions, gene/protein networks, pathways	
15	Construction and graphical analysis of large scale biological networks	
16	**Final Exam**	

SOURCES	
Lecture Notes	Lecture slides
Other Sources	Course Textbook: 1. Pevsner J., Bioinformatics and Functional Genomics, Wiley-Liss, 2009. Additional Materials: 1. Mount D.W., Bioinformatics: Sequence and Genome Analysis (2nd edition), Cold Spring Harbor Laboratory Press, 2004. 2. Jones N. C. and Pevzner P. A., An Introduction to Bioinformatics Algorithms, MIT press, 2004. 3. Pevzner P.A., Computational Molecular Biology: An Algorithmic Approach, MIT Press, 2000. 4. Krane D.E., Raymer M.L., Fundamental Concepts of Bioinformatics, Benjamin Cummings, 2003.

COURSE MATERIALS SHARING	
Documents	Lecture notes, slides
Homeworks	10
Exams	2 Midterm and 1 Final Exam

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
Midterm	2	30
Homework	10	25
Semester Project	1	25
Final Exam	1	20
Contribution of Semester Study		80
Contribution of Final Exam	1	20
TOTAL		100

Course Category	
Sciences and Mathemetics	%50
Engineering	%50
Social Sciences	%0

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS							
No	Program Qualitications	Contribution Level					
		1	2	3	4	5	
1	The skills of using mathematics, science and engineering information in advanced research				X		

2	The skills of analyzing, designing and/or implementing an original system that will be able to solve an engineering problem					X
3	The skills of using the required software, hardware and modern measurement equipments in their field of research					X
4	The skills of planning independent research and implementing in detail			X		
5	The skills of following literature, listening to and making technical presentation, writing a paper in academic level			X		
6	The skills of innovative and interrogative thinking and finding original solutions		X			

Increasing from 1 to 5

ECTS/ WORK LOAD TABLE			
Activities	Number	Duration (Hours)	Total Work Load
Course Length (includes exam weeks: 16x total course hours)	16	3	48
Out of class study time (pre-study, practice)	16	8	128
İnternet search, library work, literature search	1	5	5
Presantation			
Homework	10	5	50
Midterm Exam	2	20	40
Final Exam	1	30	30
Total Work Load			291
Total Work Load/ 30			291/30
Course ECTS Credit			10