

TEACHING PLAN

(ODD SEMESTER, 2016-17)

Course Code & Title	MB11: BIOINFORMATICS FUNDAMENTALS, 1st Semester	
Instructor	Khalid Raza, <i>Asstt. Professor</i>	
Lecture Time	4 periods per week (Consult my time table)	
Course Description	This interdisciplinary course provides a hands-on approach to students in the topics of bioinformatics. This course has been designed to introduce students the fundamental concepts of Bioinformatics, www resources, bioinformatics tools, theory and practice of computational methods, etc.	
Course Objective	<ul style="list-style-type: none"> • Introduction and historical perspective to the field of bioinformatics • Develop understanding of various biological database resources • Learn the key methods and tools used in bioinformatics • Build a solid foundation and acquire the vocabulary you need to supervise these tools • Theory & practice of computation methods, etc. 	
Text Books	T1: Anna Tramontano: Introduction to Bioinformatics , Chapman & Hall Series, 2007	
Reference Books	R1: Jin Xiong: Essential Bioinformatics , Cambridge University Press, 2011. R2: Jason T.L. Wang, Mohammed J. Zaki, Hannu T.T. Toivonene and Dennis Shasha: Data Mining in Bioinformatics, Springer International Edition, 2005 R3: Yi-Ping Phoebe Chen, Bioinformatics Technologies, Springer International Ed., 2007	
Web Resources (Tutorials)	<ul style="list-style-type: none"> • http://www.cs.columbia.edu/~cleslie/cs4761/resources.html • http://www.hku.hk/bruhk/resources.html • https://www.coursera.org/learn/bioinformatics-pku 	
Assignments	During the course 5-6 bunch of home assignments will be provided. The homework will consists of theoretical as well as practical problems. The assignments must be done individually and submitted on or before the specified date and time. Copying is strictly prohibited.	
Laboratory	The course will contain practical works on some of bioinformatics tools.	
Evaluations	Assignments and Presentation	25 Marks
	Sessional Test	
	Final Examination	75 Marks
TENTATIVE COURSE SCHEDULE		
WEEK	LECTURE TITLE	
1-2	Introductory Concepts: Bioinformatics as an Emerging Discipline, Applications of Bioinformatics in Various Areas, Overview of Available Bioinformatics Resources on the Web, Protein and Genome; Information Resources and Analysis Tools; Established Techniques and Methods; Sequence File Formats FASTA, GenBank and Structured File Formats. <i>Readings:</i> Ch. 1 (T1), Ch. 1 (R1) <i>Exercises:</i> {as provided by the teacher}	
3-4	Biological Databases: Protein Sequence and Structural Databases, Nucleotide Sequence Databases; NCBI, PubMed, Protein Data Bank (PDB), PIR, Swiss PROT, EMBL, GenBank, DDBJ, UniGene, SGD and EMI Genomes. <i>Readings:</i> Ch. 2 & 3 (T1), Ch. 2 (R1) <i>Exercises:</i> {as provided by the teacher}	
5-6	Specialized Databases: Pfam, SCOP, GO, GenBank, Genome Net, EST, SNP, Metabolic Pathways Databases, EMBL, Similar Sequence Search using BLAST, Gene/Protein Sequences and its Implications, Pair-wise Alignments, Scoring Matrix, PAM, BLOSUM and Gap Penalty. <i>Readings:</i> Ch. 4-5 (T1), Ch. 3-5 (R1) <i>Exercises:</i> {as provided by the teacher}	
7-8	Secondary Structure Analysis Tools: Sequence Motif Databases, Pfam, PROSITE, Protein Structure Classification; SCOP, CATH, Other Relevant Databases, KEGG, PQS, PMDB, MPDB. Protein Structure Alignments; Structure Superposition, RMSD, Different Structure Alignment Algorithms, DALI, and TM-align. <i>Readings:</i> Ch. 5-6 (T1), Ch. 12-14 (R1), <i>Exercises:</i> {as provided by the teacher}	
9-11	Methods of Sequence Analysis: Heuristic Methods; FASTA, Statistics of Sequence Alignment Score; E-Value, P-Value, Multiple Sequence Analysis, ClustalW, Profile, Profile-Sequence Alignment, Profile-Profile Alignment, PSI-BLAST, Hidden Markov Models, Viterbi Algorithm, and HMM Based Multiple Sequence Alignment. <i>Readings:</i> Ch. 5-7 (R1), <i>Exercises:</i> {as provided by the teacher}	
12-13	Phylogenetic Analysis: Distance and Character Based Methods and Software, Computing Tools for Phylogenetic Analysis, Distances, GROWTREE, PAUP, PHYLIP and MEGA; Construction and Visualization of Phylogenetic Tree and Application of Phylogenetic Analysis. <i>Readings:</i> Ch. 10-11 (R1) <i>Exercises:</i> {as provided by the teacher}	
14	Misc. Topic & Course Review	