

1.	Name of Course/Module	Bioinformatics Algorithms II
2.	Course Code	HPB3019
3.	Status of Subject	Major for B. Sc Bioinformatics
4.	MQF Level/Stage	Bachelor Degree – MQF Level 6
5.	Version (state the date of the last Senate approval)	May 2013
6.	Requirement for Registration	HEM2019 Probability and Biostatistics HPB2039 Bioinformatics Algorithms I
7.	Name(s) of academic/teaching staff	Dr Lee Seldon Dr Ng Chong Han Ali Afzalian Mand Teo Poh Nee
8.	Semester and Year offered	Trimester 2 (Delta level)
9.	Objective of the course/module in the programme :	To further explore the algorithms in Bioinformatics especially in the area of computational models for analysis. To provide a basic introduction on the various modeling techniques used in Bioinformatics to help in visualizing and analyzing biological problems.
10.	Learning Outcomes :	At the completion of the subject, students should be able to: LO1: Understand the method and basic techniques of biological data acquisition and visualization computing (Cognitive, Level 4) LO2: Understand the concept of computational approaches in Bioinformatics (Cognitive, Level 3) LO3: Understand the machine learning approaches such as neural network and Hidden Markov Model (Cognitive, Level 5) LO4: Apply the knowledge acquired for biological analysis and to make logical predictions (Cognitive, Level 6)
11.	Synopsis:	Gene expression data analysis. Mathematical algorithms; Hidden Markov Models; Monte Carlo Markov Chain modeling; Neural networks and artificial intelligence in data mining; Support vector machines; machine learning process; Advanced concepts in supervised and unsupervised classification of gene expression data and disease data. Determination and analysis of molecular structures; Protein and RNA structure prediction and folding; data visualization -3D structures, trees, clusters and pathways. Pengenalan, Pendekatan modular untuk menyelesaikan masalah, pembangunan alirankerja, Model "Hidden Markov", Model "Monte Carlo Markov Chain". Jaringan perhubungan Neural dan kepandaian artifisial dalam pencarian data, Mesin bantuan vektor, proses pembelajaran mesin, Konsep lanjutan dalam pengkelasan data ekspresi gen dan data penyakit. Model aliran: Sistem biologi dan Model aliran kompleks, pengvisualan data: pokok, berkelompok, dan aliran. Analisis data ekspresi gen. Analisis data ekspresi gen. Algoritma matematik; Model "Hidden Markov", Model "Monte Carlo Markov Chain"; Jaringan perhubungan Neural dan kepandaian artifisial dalam pencarian data; Mesin bantuan vector; proses pembelajaran mesin; Konsep lanjutan dalam pengkelasan data ekspresi gen dan data penyakit. Penentuan dan analisis struktur molecular; Ramalan dan lipatan struktur protein dan RNA; visualisasi data – struktur 3D, pokok, kelompok dan aliran.

12.	Mapping of Subject to Programme Outcomes :		
	Programme Outcomes		% of Contribution
	PO1: Apply soft skills in work and career related activities		12.50
	PO7: Demonstrate knowledge and understanding of essential facts, concepts, principles, and theories relating to bioinformatics		37.50
	PO8: Apply principles and knowledge of bioinformatics in relevant areas		50
13.	Assessment Methods and Types :		
	Method and Type	Description/Details	Percentage
	Test/Quiz		20%
	Lab Reports		20%
	Assignment	Report & Presentation	20%
	Final Exam		40%
14.	Details of Subject		
	Topics	Mode of Delivery	
		Lecture	Tutorial
	Algorithms in Transcriptomics – Microarrays Introduction to Gene expression Microarray Technology Gene Expression data Clustering Gene Expression data Classification	6	2
	Statistical and Computational algorithms and models Intro to Clustering and Classification Algorithms Support Vector Machine Evaluation Measurements Bayesian and statistical fundamental Classification modules <i>In-silico</i> modeling Hidden Markov modeling Monte Carlo chain modeling Machine learning approaches Fuzzy logic and AI Neural networks	8	4
	Algorithms in Proteomics Proteomics: Definition and Scope Protein Domain Protein classification and structure prediction algorithms Protein structure and classification databases Alignment strategies and methods Protein secondary and tertiary structural prediction and modeling	8	2
Model visualization Visualizing protein structures, sequence data, networks and pathways Visualization modules – Printing, maps, trees, tables	4	1	

	Prediction of RNA structure Prediction algorithms and methods - self complementary regions, minimal free energy methods, sequence covariation, stochastic context-free grammar approach.		2	1
	Total		28	10
15.	Laboratory Lab 1: Perform Clustering using Gene Expression data Lab 2: Introduction to Matlab and classification Lab 3: HMM with Matlab Lab 4: Using Matlab for classification with the iris dataset Lab 5: Protein secondary structure prediction Lab 6: Protein structure prediction with I-Tasser Lab 7: 3D visualization with Cn3D			
16.	Total Student Learning Time (SLT)	Face to Face (Hour)	Total Guided and Independent Learning	
	Lecture	28	28	
	Tutorials	10	10	
	Laboratory/Practical	14	7	
	Presentation	-	-	
	Assignment	-	12	
	Mid Term Test	1	5	
	Final Exam	2	20	
	Quiz	2 times	2	
	Sub Total	55	84	
	Total SLT	139/40 = 3.475 => 3		
17.	Credit Value	3		
18.	Reading Materials :			
	Textbook	Reference Materials		
	1. <i>Introduction to Bioinformatics: A Theoretical and Practical Approach</i> . Stephen A. Krawetz, David D. Womble. Humana Press. 2003.	1. <i>Computational Modeling of Genetic and Biochemical Networks</i> . Bower J.M. MIT Press. ISBN: 0-262-02481-0. 2001.		
	2. <i>Bioinformatics: A Practical Guide To The Analysis Of Genes And Proteins, 3Rd Ed</i> . B.F. Francis Ouellette, Andreas D. Baxevanis. BWSTM. ISBN-13: 978-8126521920. 2009	2. <i>Protein Structure Prediction-Concepts and Applications</i> . Tramontano Anna, Lesk Arthur M. ISBN: 9783527311675 John Wiley And Sons Ltd. 2006.		
	3. <i>Bioinformatics Databases, Tools, and Algorithms</i> . Bosu O., Thukral SK. Oxford Univ Press, New Delhi 2007. ISBN13: 978-0-19-567683-9	3. <i>Knowledge Discovery in Bioinformatics: Techniques, Methods, and Applications</i> . Xiaohua Hu, Yi Pan. Wiley. 2007.		
		4. <i>Bioinformatics: A Practical Guide to the Genes and Proteins Analysis</i> . Abdelmonaem Messaoudi. LAMBERT Academic Publishing. ISBN-13: 978-3844313611. 2011		

19.	<p>Appendix (to be compiled when submitting the complete syllabus for the programme) :</p> <ol style="list-style-type: none">1. Mission and Vision of the University and Faculty2. Mapping of Programme Objectives to Vision and Mission of Faculty and University3. Mapping of Programme Outcome to Programme Objectives4. Programme Objective and Outcomes (Measurement and Descriptions)
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