

1.	Name of Course/Module	Bioinformatics Algorithms I
2.	Course Code	HPB2039
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	HPB2029 Bioinformatics Programming II
7.	Name(s) of academic/teaching staff	Dr Lee Seldon Amelia Kassim Teo Poh Nee
8.	Semester and Year offered	Trimester 1 (Delta level)
9.	Objective of the course/module in the programme :	
	<ol style="list-style-type: none"> 1. To introduce the concept of algorithm development in bioinformatics. 2. To enable the students to make simple changes to an existing algorithm. 3. To enable the students to appreciate the dynamic nature of biological data and the consequent requirement of dynamic algorithm development. 4. To appreciate the divergence of biological data and the consequent requirement for innovative algorithm development. 5. To enable the student to write simple and innovative algorithms that solve complex biological data analysis problems. 	
10.	Learning Outcomes:	
	<p>At the completion of the subject, students should be able to:</p> <p>LO1: Ability to decipher the underlying statistical principles in algorithm development (Cognitive, Level 2)</p> <p>LO2: Ability to understand and apply industrially standard algorithms to meet the current requirements. (Cognitive, Level 3)</p> <p>LO3: Ability to appreciate the assumptions involved in developing an algorithm and changing the assumptions to suit different scenarios. (Cognitive, Level 4)</p> <p>LO4: Ability to write simple and innovative algorithms under different biological data analysis contexts (Cognitive, Level 5)</p>	
11.	Synopsis:	
	<p>Introduction to Data types and data sources (databases) in molecular biology. Protein, RNA and DNA sequence analysis algorithms. Sequence alignment; multiple sequence alignment matrices and Phylogenetic trees. Pathway modeling; System biology and modeling of complex pathways; visualization</p>	
	<p>Pengenalan kepada jenis data dan sumber data (basis data) dalam bidang biologi molecular. Protein, RNA dan algoritma analisis sekuens DNA. Penjajaran urutan sekuens; matrik penjajaran urutan pelbagai dan pokok-pokok filogenetik. Model aliran; Sistem biologi dan model aliran kompleks; visualisasi.</p>	
12.	Mapping of Subject to Programme Outcomes:	
	Programme Outcomes	% of Contribution
	PO1: Apply soft skills in work and career related activities	42.86

	PO7: Demonstrate knowledge and understanding of essential facts, concepts, principles, and theories relating to bioinformatics	28.57
	PO8: Apply principles and knowledge of bioinformatics in relevant areas	28.57
13.	Assessment Methods and Types :	
	Method and Type	Description/Details
		Percentage
	Test/Quiz	20%
	Lab Reports	20%
	Assignment	Report & Presentation
	Final Exam	40%
14.	Details of Subject	
	Topics	Mode of Delivery
		Lecture
		Tutorial
	Computational approaches in Bioinformatics Biodata and Tools Definition and Scope Biological Data Types and Formats Biological Datasets and Databases and accompanying tools	4
	Algorithms in Genomics I PhilGreen Phred/Phrap/Consed Pairwise sequence alignment Smith-Waterman Needleman-Wunsch	5
	Algorithms in Genomics II Multiple Sequence Alignment Substitution matrices : BLOSUM & PAM Basic Local Alignment Search Tool (BLAST) FASTA	5
	Phylogeny and Prediction Basic concept Methods-maximum pasimony, distance method, maximum likelihood approach, evolutionary model. Reliability of prediction Phylogenetic Analysis - ClustalW	6

	Protein-Protein Interaction			
	Protein function as interactions Detection methods Structure-and-sequence-based predictions		2	2
	Pathway modeling			
	KEGG (metabolic pathway, regulatory pathway) DBS. Eco-cyc-prokaryote pathway modeling. Biocyc-eukaryote pathway modeling Genetic networks Biochemical pathways Pathway tools		6	1
	Total		28	8
15.	Laboratory			
	Lab 1: Introduction to Biological Databases Lab 2: Sequence alignment: Smith Waterman, Needleman & Wunsch with default parameters. Lab 3: Sequence alignment with BLOSUM Lab 4: BLAST and FASTA Lab 5: Phylogenetic algorithms Lab 6: K-means clustering Lab 7: Introduction to pathway analysis with VANTED			
16.	Total Student Learning Time (SLT)	Face to Face (Hour)	Total Guided and Independent Learning	
	Lecture	28	28	
	Tutorials	8	8	
	Laboratory/Practical	14	7	
	Presentation	-	-	
	Assignment	-	12	
	Mid Term Test	1	5	
	Final Exam	2	20	
	Quizzes	2 times	2	
	Sub Total	53	82	
	Total SLT	135/40 = 3.375 => 3		
17.	Credit Value	3		
18.	Reading Materials :			
	Textbook	Reference Materials		

	<ol style="list-style-type: none"> 1. <i>Bioinformatics Algorithms: Techniques and Applications</i>. Ion Mandoiu, Alexander Zelikovsky. Wiley. ISBN: 978-0-470-09773-1. 2008 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 3. <i>Bioinformatics Databases, Tools, and Algorithms</i>. Bosu O & Thukral SK. Oxford Univ Press, New Delhi 2007. ISBN-13: 978-0-19-567683-9 	<ol style="list-style-type: none"> 1. <i>Essential Bioinformatics</i>. Jin Xiong. Cambridge University Press. ISBN-13: 978-0521600828. 2006. 2. <i>An Introduction to Bioinformatics Algorithms (Computational Molecular Biology)</i>. Neil C. Jones, Pavel A. Pevzner. The MIT Press. ISBN-13: 978-0262101066. 2004. 3. <i>Pattern Discovery in Bioinformatics: Theory & Algorithms</i>. Laxmi Parida. Chapman & Hall/CRC. ISBN-13: 978-1584885498. 2007. 4. <i>Protein Bioinformatics: An Algorithmic Approach to Sequence and Structure Analysis</i>. Ingvar Eidhammer, Jonassen Inge, Prof. William R Taylor. Wiley. ISBN-13: 9780470848395. 2004. 5. <i>Bioinformatics: Database and Algorithms</i>. N. Gautham. Oxford: Alpha Science. ISBN: 1842653008. 2006.
19.	Appendix (to be compiled when submitting the complete syllabus for the programme) : <ol style="list-style-type: none"> 1. Mission and Vision of the University and Faculty 2. Mapping of Programme Objectives to Vision and Mission of Faculty and University 3. Mapping of Programme Outcome to Programme Objectives 4. Programme Objective and Outcomes (Measurement and Descriptions) 	