1.	Name of Course/Module	Introduction to Molecular Biology
2.	Course Code	HMB2019
3.	Status of Subject	Core for B. Sc Bioinformatics
4.	MQF Level/Stage	Bachelor Degree – MQF Level 6
5.	Version (state the date of the last Senate approval)	June 2012
6.	Requirement for Registration	HBC1019 Biochemistry I HCB1019 Cell Biology
7.	Name(s) of academic/teaching staff	Ong Chia Sui Amelia Kassim Leila Hilout
8.	Semester and Year offered	Trimester 2 (Gamma level)
9.	Objective of the course/module in the programme :	
	1. To teach students the biology of cells at the level of the molecule with focus on genomic structure and function 2. To introduce students to the basis and pathogenic effects of disruption of gene function 3. To introduce students to the potential use of this knowledge for scientific and clinical studies 4. To provide practical information and training in the techniques used for the handling and manipulation of nucleic acid 5. To familiarize the student with the organization and operation of a basic molecular laboratory	
10.	Learning Outcomes :	
	At the completion of the subject, students should be able to: LO1: Grasp and state the the biology of cells at the molecular level. (Cognitive, Level 2) LO2: Comprehend the principles of molecular biology techniques. (Cognitive, Level 2) LO3: Explain the application of molecular biology techniques for experimental studies and in diagnostics. (Cognitive, Level 2) LO4: Apply the techniques learned as tools for molecular studies. (Psychomotor, Level 3)	
11.	Synopsis:	
	The course will cover regulation of gene expression in the prokaryotes and eukaryotes, genetic recombination, gene mutation, DNA repair and transposable elements, recombinant DNA technology and applications of DNA recombinant technology. The laboratory sessions will cover basic tools and techniques of recombinant DNA technology with emphasis on the practical aspect. The topics covered will include lab safety, DNA extraction, gel electrophoresis, sample recovery from gels, hybridization techniques, in-vitro amplification techniques, modification of DNA using enzymes and DNA sequencing.	

	Kursus ini merangkumi regulasi expresi gen dalam prokariot dan eukariot, rekombinasi genetic, mutasi gen, baik pulih gen dan bahan “transposable”, teknologi rekombinan DNA dengan penekanan pada aspek praktikal. Topik yang akan dibincang termasuk keselamatan makmal, “DNA extraction”, “gel electrophoresis”, pemulihan sample daripada gel, teknik hibridisasi, teknik in-vitro amplifikasi bagi DNA dengan menggunakan enzim dan urutan DNA.

12. Mapping of Subject to Programme Outcomes :

Programme Outcomes	**% of Contribution**
PO1: Apply soft skills in work and career related activities	33.33
PO2: Demonstrate knowledge and understanding of fundamental concepts, principles and best practices	66.67

13. Assessment Methods and Types :

Method and Type	Description/Details	Percentage
Laboratory		10%
Test/Quiz		30%
Assignment	Report & Presentation	10%
Final Exam		50%

14. Details of Subject

Topics	Mode of Delivery	
	Lecture	Tutorial
1. Proteins: The End Product of Gene Expression • One-gene : One-enzyme hypothesis • One-gene : One-protein/One-gene : One-polypeptide	1	
2. Regulation of Gene Expression in Bacteria and Phages • Lactose metabolism in *E.coli* • The *ara* regulatory protein • Tryptophan operon in *E.coli* • Genetic regulation in phage lambda • Phage transcription during lysis	3	
3. Regulation of Gene Expression in Eukaryotes • Regulatory Elements - Promoters - Enhancers • Transcription factors • Genomic alterations and gene expression - DNA methylation - Gene amplification • Posttranscriptional regulation of gene expression • Posttranslational regulation	3	1

	4. Genetic Recombination • The Holliday Model of general recombination • Recombination in *E.coli*	1	
	5. Gene Mutation, DNA repair and Transposable Elements • Random versus adaptive mutations • Classification of mutations • Detection of mutations • Molecular basis of mutations - Base substitution - Frameshift mutations - Apurinic sites - Oxidative damage - Alkylation damage - Damage caused by ultraviolet radiation and ionizing radiation • Case studies of mutations in humans • Repair of DNA - Repair by direct reversal - Base excision repair - Nucleotide excision repair - Post replication repair - Proofreading and mismatch repair - SOS response • Repair deficient disorders • Site directed mutagenesis • Transposable genetic elements	4	1
	6. Recombinant DNA Technology • Restriction enzyme • Vectors • Cloning DNA in *E.coli* • Cloning DNA in eukaryotic hosts • Constructing DNA libraries • Identifying cloned sequences • Analysis of cloned sequences • Transferring DNA in Eukaryotes	2	
	7. Applications of Recombinant DNA Technology • Mapping human gene • Diagnosing and screening • Knockout mice • Gene therapy • DNA fingerprinting • Genome analysis • Biotechnology	2	1

	8. Basic Molecular Techniques • Safety in the Molecular Biology Laboratory • Use and Care of Equipment • General Laboratory Methods • Extraction and Purification of Nucleic Acid from Living Cells • Modification of DNA using Enzymes • Basic Electrophoresis Techniques • Recovery of DNA from Electrophoresis Gels • Hybridization Techniques • *In Vitro* Amplification Techniques • Principles of DNA sequencing Techniques	10	1
	Total	**26**	**4**
15.	Laboratory		
	Lab 1 Organization of the molecular laboratory - Stocks, inventory, records - Documentation - Laboratory safety and preparation of a safety manual - Sterile techniques - Decontamination		
	Lab 2 - Measurement, micropipetting - Proper usage and care of equipment - Calibration - Preparation of reagents		
	Lab 3 Preparation of DNA from cells - Extraction and purification - Detection and quantification		
	Lab 4 *In vitro* amplification of DNA		
	Lab 5 Restriction enzyme digestion Agarose gel electrophoresis		
	Lab 6 Dot blot hybridisation - Chromogenic detection		
	Lab 7 *In vitro* amplification-Primer design		
	Lab 8 DNA Sequencing		

<table>
<tr><td rowspan="10">16.</td><td>Total Student Learning Time (SLT)</td><td>Face to Face (Hour)</td><td>Total Guided and Independent Learning</td></tr>
<tr><td>Lecture</td><td>26</td><td>26</td></tr>
<tr><td>Tutorials</td><td>4</td><td>4</td></tr>
<tr><td>Laboratory/Practical</td><td>24</td><td>12</td></tr>
<tr><td>Presentation</td><td>-</td><td>-</td></tr>
<tr><td>Assignment</td><td>-</td><td>10</td></tr>
<tr><td>Mid Term Test</td><td>1</td><td>5</td></tr>
<tr><td>Final Exam</td><td>2</td><td>20</td></tr>
<tr><td>Quiz</td><td>3 times</td><td>3</td></tr>
<tr><td>Sub Total</td><td>57</td><td>80</td></tr>
<tr><td></td><td>Total SLT</td><td colspan="2">137/40 = 3.43 => 3</td></tr>
<tr><td>17.</td><td colspan="2">Credit Value</td><td>3</td></tr>
<tr><td rowspan="3">18.</td><td colspan="3">Reading Materials :</td></tr>
<tr><td colspan="2">Textbook</td><td>Reference Materials</td></tr>
<tr><td colspan="2">1. Molecular Biology of the Gene. 6th Edition. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick. Pearson Education, Benjamin Cummings, 2008.</td><td>1. Concept of Genetics. 7th Edition. William S Klug and Michael R Cummings. Prentice Hall International, 2002.
2. Molecular Biology of the Cell. 4th Edition. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter. Garland Publishing Inc, NY, 2002.
3. Essential Biochemistry and Molecular Biology. 2nd Edition. Werner R. Appleton and Lange, 1992.</td></tr>
<tr><td>19.</td><td colspan="3">Appendix (to be compiled when submitting the complete syllabus for the programme) :
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)</td></tr>
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