Subject Description Form

Subject Code	ABCT3112
Subject Title	DNA Technology
Credit Value	3
Level	3
Pre-requisite	General Biology, General Laboratory Techniques and Safety
Objectives	This subject covers the basic principles and basic techniques of modern molecular technology used in the manipulation of DNA, genes and gene transcripts.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Appreciate the basic principles underlying the basic techniques of DNA technology; (b) Perform the commonly used techniques in molecular biology; (c) Design protocols to clone genes/DNA; (d) Design protocols to analyze cloned genes/DNA; (e) Apply the commonly used DNA techniques in biotechnology
	1) PCR A) Principle. B) DNA polymerase (source, characteristics) C) Primer design criteria (GC content, melting temperature, etc.) D) On line source for design primer E) On line source for searching genomic sequences F) Trouble shootings (right controls, primer-dimer, non-specific amplifications) **2) Cloning** - Cloning vectors structure of cloning vectors (origin of replications, promoter, drug resistance, LacZ gene, copy number) - Bacterial strains (function of bacteria in cloning; examples of bacteria: DH5alpha, BL21, etc.; different characteristics; principle behind different strains) - Restriction enzymes (discovery, characteristics, blunt end, 5'overhang, 3' overhang, 6 cutters, 4 cutters, presence of restriction sites in genome, cutting DNA with restriction enyzmes) - Ligase (discovery, activity, mechanisms) - DNA gel electrophoresis (principles and applications) - Transformation (principles behind: heat shock, $CaCl_2$, electroporation) - Antibiotic selection, blue white selection. - Isolation of plasmid DNA from bacteria (Alkaline lysis) **3) Characterization of plasmid** - Restriction mapping (illustrate with examples: plasmid with insert or self-ligation; let students practice with exercise)

4) DNA Sequencing

- Principles (Sanger sequencing, applications, teach students how to read the graph, blast search the sequence)

5) Recombinant DNA libraries

- Genomic libraries
- Chromosome libraries
- cDNA libraries

6) Applications

- DNA fingerprinting
- Gene expression
- Gene therapy

Teaching/Learning Methodology

The basic concepts and knowledge will be presented and explained to students in lectures. Through laboratory sessions, students will gain hands-on experience on the common DNA techniques. They will also be able to enhance their learning of the principles through the experiments. In tutorials, short exercises and discussions will be used to gauge their learning outcomes, to supplement, and to reinforce their learning. Students will be encouraged to further explore in depth through study aids available on the internet.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	
Attendance	5						
Laboratory Work	25	✓	✓			✓	
Test I	15	✓		✓			
Test II	15	✓			✓	✓	
Examination	40	✓		✓	✓	✓	
Total	100						

In the first written test, students will be assessed on their appreciation and understanding of the basic principle of the basic DNA techniques.

In the second written test and the examination, in addition to the basic principles, students will be required to demonstrate their ability to apply these DNA techniques in biotechnological research or industrial projects, to design protocols to clone and analyze genes.

Through laboratory performance assessment which will include works during the laboratory sessions, record keeping in the form of laboratory notebooks and a written report, students will be assessed on their ability to master the techniques, to keep accurate records, to analyze the data, to interpret the results, and to communicate their findings in a written form.

Students are required to attend at least 75% of scheduled sessions for the subject. Students fail to fulfill the attendance requirement will lose the 5% attendance score and not be eligible to register ABCT4108.

<table>
<tr><td rowspan="5">Student Study Effort Expected</td><td colspan="2">Class contact:</td><td></td></tr>
<tr><td colspan="2">▪ Lectures
▪ Tutorials
▪ Laboratory</td><td>16 Hrs.
9 Hrs.
18 Hrs.</td></tr>
<tr><td colspan="2">Other student study effort:</td><td></td></tr>
<tr><td colspan="2">▪ Self study
▪ Data Analysis and Report Writing</td><td>48 Hrs.
18 Hrs.</td></tr>
<tr><td colspan="2">Total student study effort</td><td>109 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="3"><u>Essential</u>

Peter J. Russell — iGenetics – A Molecular Approach 3rd Edition — Benjamin Cummings 2010

Sandy Primrose and Richard Twyman — Principles of Gene Manipulation and Genomics 7th Edition — Blackwell Science 2006

<u>Supplementary</u>

Joseph Sambrook and David W. Russell — The Condensed Protocols From Molecular Cloning: A Laboratory Manual — Cold Spring Harbor Laboratory Press 2006

Joseph Sambrook and David W. Russell — Molecular Cloning: A Laboratory Manual 3rd Edition — Cold Spring Harbor Laboratory Press 2001

www.geneticsplace.com

https://www.dnalc.org/

www.blackwell-science.com/primrose

http://ncbi.nih.gov</td></tr>
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