Subject Description Form

Subject Code	ABCT4103
Subject Title	Protein Biotechnology
Credit Value	3
Level	4
Pre-requisite	Biochemistry, DNA Technology & Biochemical Techniques
Objectives	To understand the concepts in protein biotechnology, including purification of proteins, protein folding mechanisms and protein engineering. To introduce protein production and application of enzymes in biotechnology industries.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand the basic concepts of protein biotechnology, protein folding and engineering; and be able to apply them in the production of biotech products. b. use chromatographic techniques in the separation of proteins. c. design and evaluate various methods for testing enzyme activities. d. apply the scouting methods as team work in bio-pilot scale of protein purification and to apply such methods for the rapid purification of proteins. e. function as an effective team member of a group and/or to be a leader in group projects which require literature search.
Subject Synopsis/ Indicative Syllabus	Protein purification (Micro to Macro): classical and modern techniques in protein purification; micropurification and analysis; purification of synthetic proteins; bulk precipitation and phase partition methods; chromatographic techniques in processing scale; FPLC system; new separation concepts. Protein folding: basic concepts; protein folding and diseases; protein-folding models; experimental approaches; crystallographic determination of protein structure. Protein engineering: site-directed mutagenesis and its application to protein structure; dissection and engineering of sites; development and testing of structural models. Protein production: production of secreted proteins in bacteria and yeast; expression of cloned genes in mammalian cells; Bacillus as an expression system; production of pharmaceutical proteins in the milk of transgenic animals; production of useful protein in transgenic plants; large scale culture of mammalian cell for production of therapeutic proteins. Industrial uses of enzymes: enzymes in food biotechnology and industry; enzymes in organic synthesis; enzymes in analysis and medicines; enzymes in genetic engineering.

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<tr><td>Teaching/Learning Methodology</td><td>The basic concepts and knowledge will be presented and explained to students in lectures. A lab quiz will be given to students before the experiments in order to facilitate students' active learning in laboratory sessions. Through the lab classes, students will gain hands-on experience on common protein 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 and in the library.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td></tr>
<tr><td>1. Lab attendance and Lab Quiz</td><td>5%</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>3. Lab report</td><td>15%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>4. Mid-term Quiz</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>5. Examination</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Lab attendance, quizzes, lab report and examination are used to gauge how much students have learned in protein biotechnology and its applications. Writing skills will be assessed in all the assessment tasks and methods. The laboratories and laboratory reports in particular demand students to demonstrate their competence in the execution of enzyme assays, in devising protocols for protein purifications and in the interpretation and analysis of experimental data. Also, students' technical skills as a leader and/or member of a team will also be assessed.</td></tr>
<tr><td rowspan="4">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>24 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>4 Hrs.</td></tr>
<tr><td>▪ Laboratory</td><td>12 Hrs.</td></tr>
<tr><td rowspan="4"></td><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Report writing</td><td>12 Hrs.</td></tr>
<tr><td>▪ Self study</td><td>66 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>118 Hrs.</td></tr>
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Reading List and References	Essential Ratledge C & Kristiansen B Basic Biotechnology 3rd Edition Cambridge 2006 Walsh G Biopharmaceuticals: biochemistry and biotechnology 2nd Edition Wiley 2003 Supplementary Langel U Introduction to peptides and proteins CRC 2010 Fersht A Structure and mechanism in protein science : a guide to enzyme catalysis and protein folding Freeman 1999 Branden C & Tooze J Introduction to protein structure 2nd Ed. Garland 1999 http://ncbi.nih.gov