Subject Description Form

Subject Code	ABCT4778
Subject Title	CHEMICAL & BIOPROCESS TECHNOLOGY LABORATORY
Credit Value	2
Level	4
Co-requisite	CHEMICAL & BIOPROCESS TECHNOLOGY
Objectives	This aim of this subject is to demonstrate, reinforce and extend the principles of chemical & bioprocess technology, which are covered in ABCT3747 and 4777. Students are able to acquire the knowledge of the mechanical configuration and operation of some important process units including distillation, rising film evaporator, tray drying, chemical reactors and heat exchanger through experiment planning and conduction through team work effort. Data analysis, calculation and technical reports writing will be emphasized.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. demonstrate knowledge of the mechanical configuration and operation of some important process units; b. measure, monitor and control the common process variables and conditions such as temperature, pressure and flow; c. apply the theory and concepts learnt in related process technology subjects to analyze experimental data and to derive the process parameters; d. work in a team to plan and conduct experiments, analyze and present experimental results, and write technical reports.
Subject Synopsis/ Indicative Syllabus	<u>Distillation</u> Study of the separation of a binary mixture in a batch distillation process with a tray tower at different reflux ratios: measurement of the concentration profiles along the tower, and calculation of the plate efficiency. <u>Rising-Film Evaporator</u> Concentration of a solution in a rising-film evaporator: study of the effect of steam temperature on the rate of evaporation and rate of heat transfer, estimation of the overall heat transfer coefficient. <u>Tray Drying</u> Introducing a simple batch drying process at constant-drying conditions, where the air velocity, humidity, temperature, and direction of air are constant throughout the drying period.

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<u>Chemical Reactor</u>
Study of reaction kinetics in a well-mixed batch chemical reactor: measurement of the concentrations of reactants as a function of time at various reaction temperatures, determination of the reaction rate constant and its relationship with temperature.

<u>Heat exchanger</u>
Study of an example of shell and tube heat exchanger: measurement of heat flow and temperature change in counter-current and co-current flow mode.
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<tr><td>Teaching/Learning Methodology</td><td>
Students will be divided into groups to plan and conduct experiments, and they are required to observe, do data analysis, present results and write formal technical reports in their respective group.
A pre-lab tutorial will be conducted to major lab techniques, principles and safety requirements. Students are required to read the lab manual beforehand.
Technicians and demonstrators will stand by to assist, supervise and observe the students' performance of the lab experiments.
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<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="6">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></td><td></td></tr>
<tr><td>1. Lab performance</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Report + Quiz</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Three components: (1) Behavior and performance in the lab; (2) a written quiz on the lab concepts and procedures; (3) a written report on each experiment.
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<tr><td>Student Study Effort Expected</td><td>
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<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Laboratory</td><td>21 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self study (reading textbooks, reference books, etc)</td><td>20 Hrs.</td></tr>
<tr><td>▪ Writing lab reports and group discussion</td><td>20 Hrs.</td></tr>
<tr><td>▪ Pre-laboratory study</td><td>5 Hrs</td></tr>
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	Total student study effort		66 Hrs.
Reading List and References	Geankoplis C J	Transport Processes and Separation Process Principles (includes Unit Operations), 4th ed.	Prentice Hall, 2003
	McCabe W L Smith J C & Harriott P	Unit Operations of Chemical Engineering, 5th ed.	McGraw-Hill, 1993
	Perry R H & Chilton C H	Chemical Engineers Handbook, 6th ed.	McGraw-Hill, 2008
	Fogler H S	Elements of Chemical Reaction Engineering, 4th ed.	Prentice Hall, 2006