Subject Description Form

Subject Code	ABCT3747
Subject Title	INTRODUCTION TO CHEMICAL & BIOPROCESS TECHNOLOGY
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Physics I (AP10005) / Physics for Chemical and Biological Sciences (AP10011); Calculus and Linear Algebra (AMA1007) / ABCT1001 Quantitative Skills for Chemical and Life Sciences; Or their equivalents.
Objectives	To provide the basic knowledge of the common processes and equipment in chemical, biotechnology and other related industries, and to introduce the basic principles of chemical and bioprocess engineering, with particular emphasis on the quantitative expression of process conditions and material properties, and the calculation of material and energy balances, and heat transfer.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. demonstrate the general process formats for manufacture of chemical and biochemical products, and recognize the functions of process units for the processing of raw materials and products; b. grasp the basic concepts of common separation processes, and their applications for separation and purification of chemical and biological products, and for removal of pollutants from water, air, and wastes; c. apply the elementary chemical engineering principles to analyze and solve material and energy balance problems, and to quantify the material and energy requirements in chemical, biochemical and related processes.
Subject Synopsis/ Indicative Syllabus	<u>Basic Concepts of Process Technology (3 hrs)</u> The composition and layout of common processes in the chemical, biotechnology and other related industries such as food and pharmaceutical processes, including the major process units and operations, and their functions. <u>Engineering Terms and Measurements (3 hrs)</u> Dimension and units; definition and measurement of process variables: temperature, pressure, flow rate and mixture composition; properties of materials: ideal gas law. <u>Brief Overview of Separation Processes (3 hrs)</u> General concepts and classification of separation processes (unit operations); common separation processes in chemical and bioprocess plants, e.g. evaporation, filtration, centrifugation, drying, absorption, distillation, extraction, and membrane processes. <u>Material and Energy Balances (9 hrs)</u> Laws of mass and energy conservation; Material balances for separation (unit operations), chemical and biochemical reaction processes, and other natural and industrial processes; product yield in biological processes and oxygen balance in bioreactors. Thermodynamic properties of liquids and

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<tr><td></td><td>gases, enthalpy change in systems with and without phase transition, and heats of reaction; heat and enthalpy balances for physical and reactive processes.

<u>Fluid Properties and Flow (6 hrs)</u>

Basic characteristics of fluids: hydrostatic pressure, fluid viscosity and non-Newtonian fluid rheology, laminar and turbulent flow; fluid flow energy balances, friction losses.

<u>Principles of Heat Transfer (6 hrs)</u>

Basic means of heat transfer: conduction, convection and radiation; heat transfer in solids and fluids; heat transfer coefficients; common heat-transfer equipment (heat exchangers); heat transfer and energy balances in evaporation; heat transfer and temperature control in bioreactors.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>1. Lectures and tutorials.
2. Exercises, assignments and tests.
3. Questions, consultation and discussion.
4. T/L aids: power point slides, handouts, subject web, and reference books.</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="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></td><td></td><td></td></tr>
<tr><td>1. Final exam</td><td>50</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>2. Course work</td><td>50</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:
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures</td><td>27 Hrs.</td></tr>
<tr><td>▪ Tutorials</td><td>12 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and revising</td><td>46 Hrs.</td></tr>
<tr><td>▪ Exercises & assignments</td><td>32 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>120 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>1. Geankoplis C J: Transport Processes and Separation Process Principles, Prentice Hall 2003-.
2. Doran PM: Bioprocess Engineering Principles, Harcourt Brace & Company, 1998; 2013.
3. Felder R M & Rousseau RW: Elementary Principles of Chemical Processes, John Wiley & Sons 1996-.
4. Himmelblau D M: Basic Principles and Calculations in Chemical Engineering, Prentice Hall 1989-.</td></tr>
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