KC32603 PROCESS SIMULATION AND INTEGRATION
Chemical Engineering Programme, Faculty of Engineering
Chemical Engineering Process Simulation Project 1
Semester 2 2021/2022

1.0 Introduction

Chemical engineering process simulation project 1 is one of the continuous assessments designed for KC32603 and carries 10 % of the total marks for this course. An open-ended problem is given where the students will have to propose design solution for chemical engineering process simulation. The students will also expose in designing and simulating chemical engineering processes using Aspen HYSYS process simulator using knowledge profiles (fundamentals, specialist, engineering design & engineering practices).

2.0 Course Outcomes (COs), Programme Outcomes (POs) and Complex Engineering Problems (WP) & Knowledge Profiles (WK)

This project is constructively aligned with the intended Course Outcomes (COs), Programme Outcomes (POs) and Complex Engineering Problems (WP) and Knowledge Profiles (WK) characteristics as shown in Table 1.

Table 1: Mapping of CO, PO, WP and WK

Course Outcome	Programme Outcome	Complex Problems Characteristics/Taxonomy Level
CO2: Design solutions for complex chemical engineering process design problems that able to improve process productivity and energy saving.	PO3: Design/Development of Solutions – Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations (WK5).	Cognitive Domain – C6 **WP1 – In-depth engineering knowledge** at the level of one or more of WK3, WK4, WK5 and WK6 which allows a fundamental based, first principles analytical approach; **Required WKs are**: **WK3**: A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline. **WK4**: Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline. **WK5**: Knowledge, including efficient resource use, environmental impacts, whole-life costs, re-use of resources, net-zero carbon, and similar concepts, that supports **engineering design and operation** in a practice area. **WK6**: Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline. **The other WPs are**: **WP3 – Depth analysis required**: Have no obvious solution and requires abstract thinking, originality in analysis to formulate suitable models. **WP4 – Familiarity of issues**: Unfamiliar or infrequently encountered issues. WP7 – Interdependence: High level problems including many component parts or sub-problems.

3.0 Learning Outcomes

At the end of this project, the students should be able to:

1. Analyse complex chemical engineering process design problems.
2. Simulate complex chemical engineering process design problems using Aspen HYSYS process simulator.
3. Design solution for complex chemical engineering process design problems that able to improve process productivity or energy saving.

4.0 Problem Description

Chemical engineering plant is a complex process which consists of several reaction systems as well as several separation systems. Your team has been assigned to design a new chemical plant that will be built at the Kota Kinabalu Industrial Park (KKIP) area. Your team needs to decide what kind of chemical product that will be produced which taking into consideration the raw materials available nearby. With that selected chemical product, your team need to synthesize the process, design the process, simulate the process, and optimize the process that able to produce the selected product with the higher productivity and less energy separation

5.0 Instruction for the Chemical Engineering Process Simulation

In order to accomplish this project, your team needs to satisfy these following tasks:

Task 1: Process Synthesis
Synthesize the desired reaction and separation systems. Draw the block flow diagram of this process and show the related information.

Task 2: Process Design
Design the suitable process and justify the selected equipment. Draw the process flow diagram of this process and show the related information.

Task 3: Process Simulation
Simulate your designed process. Define your base case first (i.e. initial conversion, direct sequence). Show your simulated process and printout the streams summary.

Task 4: Process Optimization
Optimize your simulated process based on these objective functions: the highest desired product production for reaction system, and the less energy requirement for separation system.

The mapping of complex engineering problem with the tasks of this project is summarized as shown in Table 2.

Table 2: Mapping of Complex Engineering Problems with tasks

Tasks	CO	PO	Marks	WPs
Task 1: Process Synthesis	CO2	PO3	25 %	**WP1 - Depth of Knowledge Required** Engineering Problem Solving & Engineering, Chemical Process Principles, Thermodynamics, Process Design, Mass Transfer & Separation Processes, Process Simulation & Integration. **WP2 - Range of Conflicting Requirements** Highest reactor production, less energy separation. **WP3 - Depth of Analysis Required** Process synthesis, process design, process simulation, process optimization. **WP4 - Familiarity of Issues** Unfamiliar issue only applicable to the project. **WP5 - Extent of Applicable Codes** Aspen HYSYS process simulation.
Task 2: Process Design			25 %	
Task 3: Process Simulation			25 %	
Task 4: Process Optimization			25 %	