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

1.0 Introduction

Chemical engineering process simulation project 2 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
CO3: Design solutions for complex chemical engineering process integration 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 separation process design problems.
2. Simulate complex chemical engineering separation process design problems using Aspen HYSYS process simulator.
3. Design solution for complex chemical engineering separation process design problems that able to improve process productivity or energy saving.

4.0 Problem Description

Hydrocarbon mixtures fractionation process is a complex separation process which consists of several separation systems to recover individual hydrocarbon products. Your team has been assigned to design a new hydrocarbon mixture fractionation plant that will be built at the area of Sabah Oil and Gas Terminal (SOGT), Kimanis. Your team needs to decide what kind of hydrocarbon mixture feed that will be separated (between seven and ten components). With that selected hydrocarbon mixture feed, your team need to synthesize the process, design the process, simulate the process, and optimize the process that able to produce high purity individual hydrocarbon product with 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 and Design
- Synthesize the desired separation systems. Draw the block flow diagram of this process and show the related information.
- Design the suitable separation process and justify the selected equipment (direct sequence). Draw the process flow diagram of this process and show the related information.

Task 2: Process Simulation and Optimization
- Simulate your designed process. Show your simulated process and printout the streams summary.
- Optimize your simulated process based on these objective functions: higher desired product purities with 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 and Design	CO2	PO3	50 %	**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 Simulation and Optimization			50 %	