COURSE INFORMATION

Faculty:	Faculty of Engineering	**Page:**	1 of 5
Programme:	Chemical Engineering		
Course code:	KC32603	**Academic Session/Semester:**	2021-2022/2
Course name:	Process Simulation and Integration	**Pre/co requisite (course name and code, if applicable):**	
Credit hours:	3		

Course Synopsis	This course has been designed to illustrate the use of process simulation as a tool for the analysis of chemical processes and for the conceptual design of unit operations. In the last years, chemical process simulation has become of significant importance due to the evolution of computing tools, which have opened a wider spectrum of possibilities in the use of applications for process integration. The abovementioned application added to the need of performing calculations in a fast way in order to focus in the analysis of the obtained information and on other relevant aspects such as safety, green engineering, economic profitability, and many other factors that make the solutions of engineering more competitive. This course is divided into third parts. The first part is about fundamental of process simulation and application of process simulation for individual unit operations. Then in the second part, all the fundamental knowledge of process simulation will be applied in the complete chemical process. The third part is where the application of process integration will be applied in order to design complex chemical engineering process with specific aspects as mentioned above. This course implements active learning, cooperative learning as well as blended learning in all teaching and learning activities.
Course Learning Outcomes (CLOs)	At the end of this semester, students will be able to: 1. Systematically analyze complex chemical engineering process design problems using the applicable chemical engineering process simulator. 2. Design solutions for complex chemical engineering process design problems that able to improve process productivity and energy saving. 3. Design solutions for complex chemical engineering process integration design problems that able to improve process productivity and energy saving. 4. Apply the applicable process simulation concept of Aspen HYSYS process simulator in designing individual chemical engineering unit operations as well as complete and complex chemical engineering process design problems.
Course Schedule	Thursday 14:00 – 16:00 (Makmal Umum 2, FKJ) Friday 8:00 – 10:00 (Makmal Umum 2, FKJ)

Course lecturer	**Name**	**Office**	**Contact no.**	**E-mail**
	Assoc. Prof. Ts. Dr. Mohd Kamaruddin bin Abd Hamid	A-11	0137790426	kamaruddinhamid@ums.edu.my

Mapping of the Course Learning Outcomes (CLO) to the Programme Learning Outcomes (PLO), Teaching & Learning (T&L) methods and Assessment methods:

No.	Course Learning Outcomes	PLO	Taxonomies Level	T&L Methods	Assessment Methods
CLO 1	Systematically **analyze** complex chemical engineering process design problems using the applicable chemical engineering process simulator.	PLO 2	C4 (analyze)	Active learning, Cooperative Learning, Blended Learning	In-Classs Exercises, Mid-Term Test, Final Exam
CLO 2	**Design** solutions for complex chemical engineering process design problems that able to improve process productivity and energy saving.	PLO 3	C6 (design)	Active learning, Cooperative Learning, Blended Learning	Quizzes, Progress Reports, Project Report
CLO 3	**Design** solutions for complex chemical engineering process integration design	PLO 3	C6 (design)	Active learning, Cooperative	Quizzes, Progress

	problems that able to improve process productivity and energy saving.			Learning, Blended Learning	Reports, Project Report
CLO 4	**Apply** the applicable process simulation concept of Aspen HYSYS process simulator in designing individual chemical engineering unit operations as well as complete and complex chemical engineering process design problems.	PLO 5	C3 (apply)	Active learning, Cooperative Learning, Blended Learning	In-Class Exercises, Mid-Term Test, Final Exam

Details on Innovative T&L practices:

No.	Type	Implementation
1.	Active learning	Conducted through in-class activities.
2.	Cooperative learning	Conducted through design projects. Students in a team of five will be given two design projects that require chemical engineering process design solutions involving the application of process simulator. Compliance to the design specifications need to be given in the form of written reports.
3.	Blended learning	Conducted through Learning Management System (LMS) of UMS SmartV3. All information as well as materials related to teaching and learning activities will be given prior to class through this system. Some for formative assessments will be also conducted using this system.

Weekly Schedule:

Week 1	**Introduction** Introduction to Process Design, Simulation and Integration
Week 2	**Process Simulation Using Aspen HYSYS** Part 1: Equation of state, pressure-related equipment, temperature-related equipment **In-Class Exercise 1**
Week 3	**Process Simulation Using Aspen HYSYS** Part 2: Reaction systems **In-Class Exercise 2**
Week 4	**Process Simulation Using Aspen HYSYS** Part 3: Separation systems **In-Class Exercise 3**
Week 5	**Reaction Systems in Series** Conversion-Equilibrium Reactions
Week 6	**Separation Systems in Series** Flash-Distillation Column, Distillation Columns Sequence **In-Class Exercise 4**
Week 7	**Reaction-Separation Systems** Reaction-Separation Systems **In-Class Exercise 5**
Week 8	**Mid-Semester Break**
Week 9	**Chemical Engineering Process Design: Simulation Project 1** Chemical Engineering Process Design

	Quiz 1
Week 10	Chemical Engineering Process Design **Quiz 2**
Week 11	Chemical Engineering Process Design **Quiz 3**
Week 12	**Chemical Engineering Process Integration Design: Simulation Project 2** Chemical Engineering Process Integration Design **Quiz 4**
Week 13	Chemical Engineering Process Integration Design **Quiz 5**
Week 14	Chemical Engineering Process Integration Design

Transferable skills (generic skills learned in course of study which can be useful and utilised in other settings):

Team working
Life-long learning
Communication

Student learning time (SLT) details:

Student Learning Time (SLT)	**Teaching and Learning Activities**										**TOTAL SLT**
	Guided Learning (Face to Face)				**Guided Learning (Online)**				**Guided Learning Non-Face to Face**	**Independent Learning Non-Face to face**	
CLO	**L**	**T**	**P**	**O**	**L**	**T**	**P**	**O**			
CLO 1	3h			6h				6h	3h	5h	**23h**
CLO 2				6h					3h	10h	**19h**
CLO 3				6h					3h	10h	**19h**
CLO 4				8h				26h	8h	5h	**47h**
Total SLT	**3h**			**26h**				**32h**	**17h**	**30h**	**108h**

	Continuous Assessment	CLO	Percentage	Total SLT
1	Quizzes	CLO 2 CLO 3	10	**4h**
2	In-Class Exercises	CLO 1 CLO 4	15	**2h**
3	Mid-Term Test	CLO 1 CLO 4	15	**3h**
4	Project Report 1	CLO 2	10	As in CLO 2
5	Project Report 2	CLO 3	10	As in CLO 3
	Final Assessment		Percentage	Total SLT
1	Final Examination	CLO 1 CLO 4	40	**3h**
Grand Total			**100**	**120h**

Course Learning Outcomes (CLOs), Programme Learning Outcomes (PLOs) and Complex Engineering Problems (WP) & Knowledge Profiles (WK)

Assessments	CLO	Domain Level	PLO	Complex Problems Characteristics	Deliverables
Quizzes	CLO 2 CLO 3	C6	PLO 3	WK3, WK4, WK5, WK6 WP1, WP4	
In-Class Exercises	CLO 1 CLO 4	C4 C3	PLO 2 PLO 5	WK3, WK4, WK5, WK6 WP1, WP4	• Solution planning • Simulation results
Simulation Project 1	CLO 2	C6	PLO 3	WK3, WK4, WK5, WK6 WP1, WP3, WP4, WP7	• Progress reports • Final report
Simulation Project 2	CLO 3	C6	PLO 3	WK3, WK4, WK5, WK6 WP1, WP3, WP4, WP7	• Progress reports • Final report
Mid-Term Test	CLO 1 CLO 4	C4 C3	PLO 2 PLO 5	WK3, WK4, WK5, WK6 WP1, WP4	
Final Exam	CLO 1 CLO 4	C4 C3	PLO 2 PLO 5	WK3, WK4, WK5, WK6 WP1, WP4	

Special requirement to deliver the course:

Computer lab with Aspen HYSYS

Learning resources:

Main references

Ivan Dario Gil Chaves, Javier Ricardo Guevara Lopez, Jose Luis Garcia Zapata, Alexander Leguizamon Robayo, & Gerardo Rodriquez Nino (2016), *Process Analysis and Simulation in Chemical Engineering*. Springer. ISBN: 978-3-319-14812-0.

Juma Haydary (2019), Chemical Process Design and Simulation: Aspen Plus and Aspen HYSYS Applications. AIChE-Wiley. ISBN: 978-1-119-31143-0.

Nayef Ghazem (2018), *Modeling and Simulation of Chemical Process Systems*. Taylor & Francis. ISBN: 978-0-203-70508-7.

Dominic Chwan Yee Foo (Eds.) (2017), *Chemical Engineering Process Simulation*. Elsevier. ISBN: 978-0-128-03782-9.

Academic honesty and plagiarism:

It is contrary to justice, academic integrity, and to the spirit of intellectual inquiry to submit another's statements or ideas as one's own work. To do so is plagiarism or cheating, offenses punishable under the University's disciplinary system. Because these offenses undercut the distinctive moral and intellectual character of the University, we take them very seriously.

Proper acknowledgment of another's ideas, whether by direct quotation or paraphrase, is expected. In particular, if any written or electronic source is consulted and material is used from that source, directly or indirectly, the source should be identified by author, title, and page number, or by website and date accessed. Any doubts about what constitutes "use" should be addressed to the instructor.

Copying of work (texts, simulation results etc.) from other students/teams or from other sources is not allowed. Existing texts should be reformulated with your own words used to explain what you have read. It is not acceptable to retype existing texts and just acknowledge the source as a reference. Be warned: students who submit copied work will obtain a mark of **zero** for the assignment and disciplinary steps may be taken by the Faculty. It is also unacceptable to do somebody else's work, to lend your work to them or to make your work available to them to copy.

Other additional information:

All teaching and learning activities are team tasks unless explicitly indicated as individual tasks. During those activities, all students are required to actively participate. Peer rating will be implemented at the end of each activity especially for design project to measure students' participation.

All students are required to attend the class unless given a notice in advanced. Attendance will be taken in the first five minutes before the class started either face-to-face or online.

All given assignments must be submitted through UMS Learning Management System (LMS) SmartV3 before the deadline. The marks of the late submission will be deducted. It is advisable for students to consult the instructor in the case of late submission.

Disclaimer: