Department of Chemical – Petrochemical Engineering

College of Engineering

University of Salahaddin - Hawler

Subject: Process Modeling and Simulation (PM&S)

Course Book – Year – 4th, Semester – 8th

Lecturer's name: Mr. Serwan Ibrahem AbdulKhader

Academic Year: 2023- 2024

Course Book

1. Course name	**PM&S**
2. Lecturer in charge	**Mr. Serwan Ibrahem Abdulkhader**
3. Department/ College	**Chemical and Petrochemical Engineering / Engineering**
4. Contact	**e-mail: Serwan.abdulkhader@su.edu.krd** **Tel: (optional)**
5. Time (in hours) per week	**Theory: 04 (Theoretical : 02 Tutorial 02)** **Practical: 0**
6. Office hours	**10 hours**
7. Course code	
8. Teacher's academic profile	**B.Sc. Chemical Engineering – 1996** **M.Sc. Phase Equilibria – 2005** **Worked as academic employment (University lecture) from 2014.**
9. Keywords	**Equation-Oriented Approach, Sequential Modular Approach, and Onion Model.**

10. Course overview:

Process simulation is the representation of a chemical process by a mathematical model, which is then solved to obtain information about the performance of the chemical process. It is also known as process flowsheeting

1. A **theoretical** weekly program of **Four** hours.
2. A **practical** weekly program of **zero** hours.

11. Course objective:

1. Acquire specialized knowledge in modelling the engineering problems and solve by new methods with good accuracy.
2. Use the update advanced design equation and compare the results with the engineering analysis methods results
3. Opportunity of deep analysis of selecting the most proper type of reactor .

12. Student's obligation

For the student to achieve a level of excellence in the subject, the following items should be given utmost consideration:

a. Class attendance on regular basis for learning.
b. Active participation in class discussions.
c. Reviewing the lecture notes and topics on weekly basis, noting the ambiguous points, if any, and requesting clarification during instructor office hours.

d. Visiting the library on regular basis and checking the internet for other approaches or simplifications of topics and ideas.
e. Giving adequate and sufficient priority to preparing for weekly, monthly and final tests.

13. Forms of teaching

Due to very equations and rules driving, the essence of teaching program is presented on white board. Sometimes, some explanations of details are prepared on MS power point. There are also assignments and seasonal projects appointed to individual students or groups that help the evaluation process and also support team work effort.

14. Assessment scheme

Attaining the requirements set to succeed in Mass Transfer – I, requires developing an engineer sense, relating to this topic, based on an emergent analytical and problem solving skills and memorizing topics can't secure success. In education system, the maximum mark is (100 %). The grading system is based on the summation of 2-categories of evaluations as:

a. First, (40 %) of the mark is based on an academic semester effort of the student which includes but is not restricted to the following:
   - One examination (25 %), for which the study material is set for the topics reviewed in that particular semester.
   - Quizzes (5 % multiple by 2) = 10 %, for which the study material is limited and assigned by the instructor.

   Active participation of the student in the classroom attendance, activities and discussions may be rewarded by the instructor for up to a limit not exceeding (5 %) as a general support margin, on the same basis for all of the students.

b. Second, (60 %) of the mark is based on a final examination that is comprehensive for the whole of the study material reviewed during an academic semester and it usually occurs during the month of January of each year.

   At the end of the evaluation process, if the students could not secure a minimum of (50 %), they are given a chance to repeat the final examination after two weeks and they should be able by then to equal or exceed the (50 %) limit otherwise they will have to repeat this subject during the next academic year if it did not contradict with the administrative regulations.

15. Student learning outcome:

Upon completion of the subject, students will be able to:

a. Obtain fundamental knowledge in the area of modes of stoichiometry and chemical reactor design .
b. Apply their knowledge, skills and hand-on experience to the analysis of effect of multiple reaction on selection of reactor
c. Extend their knowledge of chemical engineering to different situations of engineering context and professional practice in Transforming Phenomenon.
d. Recognize the need for and an ability to engage in life-long learning.

16. Course Reading List and References:

1. - Chemical Engineering Process Simulation, Second Edition, Elsevier, 2017.

17. The Topics:	Lecturer's name
Chapter One – **Introduction to Process Simulation**	Mr. Serwan Ibrahem
1.1 flowsheeting	
1.2 Process Design & Simulation	
1.3 onion model	
Chapter Two – **Basic Architectures For Commercial Software**	
2.1 SM and EO approaches	
Chapter Three - **Basic Algorithms For Process Simulation**	
3.1 Sequential Modular Approach	
3.2 convergence	
3.3 tear stream	
Chapter Four – **Equation-Oriented Approach**	
4.1 The main advantage	
Chapter Five – **Ten Good Habits for Process Simulation**	
5.1 You build a simulation model to meet an objective	
5.2 Identify the system or process and draw an envelope around it	
5.3 Imagine what is going on physically	
5.4 Translate the physical model to a mathematical model	
5.5 Know your components	

5.6 Know the context of your feed streams	
5.7 Know your components boiling points	
5.8 Keep track of the units of measure in all calculations	
5.9 Always do a simple material and energy balance first	
5.10 Plot the phase envelope for important streams	

19. Examinations:

Q1:30%

Complete the sentences with precise words or phrases (each blank equals three marks).

1. The flowsheeting is use of ---------- to perform steady state --------- and ------- balancing, ----------, and ---------- calculations for a chemical process.

2. The aim for process simulation is to predict how a defined process would ----------under a given set of ----------.

3. The selection of thermodynamic model is a ---------- step, as different thermodynamic ---------- will lead to very different ---------- for some processes.

Q2: 30%

1. What is the final step in basic architectures for commercial software, and why this software must to do this step?

2. What is the problem with tray-by-tray distillation model? , and what is the alternative model, explain it in brief.

Q3: 40%

1. Make a comprehensive comparison between SM and EO approaches.

2. Can you use a commercial software like Aspen HYSYS or UniSim Design to simulate bio refinery unit? Explain the reason in brief.

20. Extra notes:

Due to a number of unforeseen reasons that may lead to shifting of the academic year program, it may be subjected to modifications. Also extra curriculum hours may be needed to cover all the topics. The students shall be notified of the changes if and when they may occur.

21. Peer review **پێداچوونەوەی هاوەڵ**