Department of Chemical – Petrochemical Engineering

College of Engineering

University of Salahaddin - Hawler

Subject: Chemical Reactor Design II

Course Book – Year – 3rd, Semester – 6th

Lecturer's name: Mr. Serwan Ibrahem AbdulKhader

Academic Year: 2023- 2024

Course Book

1. Course name	**Chemical Reactor Design II**
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	**5 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 2007.**
9. Keywords	**Batch reactor , Plug flow reactor , CSTR , and Stoichiometry**

10. Course overview:

The course treats the basic methods used in chemical reactors types designing and elucidates the basics about the modelling of problem. Also treat the following general topics:

1. Covers an how to start the chemical reactors design depending on chemical reaction information.
2. Study the effect of multiple reaction on chemical reactor design

1. A **theoretical** weekly program of **three** 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. - Principles of Chemical Reactor Analysis And Design, Second Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2009.

17. The Topics:	Lecturer's name
Chapter One – **1. Species Balances and Design Equations**	Mr. Serwan Ibrahem Aljaff
1.1 microscopic balances	
1.2 macroscopic balances	
1.3 The general conservation statement	
Chapter Two – **Macroscopic Species Balances—general Species-based Design Equations**	
2.1 Review	
Chapter Three - **Species-based Design Equations of Ideal Reactors**	
3.1 Ideal Batch Reactor	
3.2 Continuous Stirred-Tank Reactor (CSTR)	
3.3 Plug-Flow Reactor (PFR)	
Chapter Four – **Reaction-based Design Equations**	
4.1 Ideal Batch Reactor	
4.2 Continuous Stirred-Tank Reactor (CSTR)	
4.3 Plug-Flow Reactor (PFR)	
4.4 Formulation Procedure	

Chapter Five – **Dimensionless Design Equations and Operating Curves**	
5.1 Ideal Batch Reactor	
5.2 Continuous Stirred-Tank Reactor (CSTR)	
5.3 Plug-Flow Reactor (PFR)	

19. Examinations:

Example 3.3 The homogeneous chemical reaction

$$A + B \longrightarrow C$$

is carried out in a batch reactor. The reaction is first order with respect to reactant A, and the order of reactant B is 1.5. Initially, the reactor contains 2 mol of A, 3 mol of B, and 0.5 mol of C, and its initial volume is 2 L. The reaction rate constant at the initial temperature is 0.1 $(L/mol)^{1.5}$ min^{-1}. Determine the characteristic reaction time.

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**