The University of Jordan
School of Engineering
Chemical Engineering Department

Professor Reyad Shawabkeh
Office Hours: S.T.Th (10:00 – 11:00)

Course Description

Chemical reaction engineering is one of the most important fields of chemical engineering science. Chemical engineers are expected to work in the industry, where a reactor design and processing is really crucial. As a result, this course aims at improving the students' knowledge in the chemical reaction engineering by introducing them to the many reaction engineering categories that have not been covered in the Chemical Reaction Engineering I course; such as non-ideal reactors and heterogeneous reacting system. Furthermore, this course will be of a great help in preparing the students to the future challenges of their engineering career.

Topics to be covered

1. Review
2. Non-elementary Reactions
3. Introduction to design for heterogeneous reacting systems
4. Solid catalyzed reactions
5. Deactivating catalysts
6. Residence time distribution
7. Non ideal reactors

Evaluation

Assessment Tool	Expected Due Date	Weight
In class activities		10%
First Test	Sunday, October 14, 2018	25%
Second Test	Sunday, November 25, 2018	25%
Final Exam	University final examination schedule	40 %

Text book

Fogler, Elements of Chemical Reaction Engineering, 4th Ed., Prentice Hall, 2006..

References

1. O. Levenspiel, Chemical Reaction Engineering, 3rd Ed. Wiley, 1999.
2. R. Cooper, G. V. Jeffreys, Chemical Kinetics and Reactor Design, Oliver and Boyd 1999.

Course objectives

1. To Revise the Chemical Reaction Engineering concepts including temperature and pressure effects.
2. To introduce the design for heterogeneous reacting systems.
3. To define the solid catalyzed reactions.
4. To illustrate the deactivating catalysts, Mechanism, rate equation, rate equation from experiment, design.
5. To define the non-ideal flow.

Course Outcomes

1. Students should have revised the concepts of chemical reaction engineering concepts including what had been taken during Chemical Reaction Engineering I course (1).
2. Students should be familiar with the definitions of rate equations, and contacting patterns (1).
3. Student should have good knowledge in the rate equation of the solid catalyzed reactions, its experimental methods for finding rates, the product distribution in multiple reactions, and its application to design (1).
4. Students are expected to be familiar with the definition of deactivating catalysts, its mechanism, its rate equation, and design (1,7).
5. Students should be have a good knowledge about the non-ideal flow: Residence time distribution of flow in vessels, models for non-ideal flow, dispersion model, tanks in series model, multi parameter model, diagnosing ills of Operating equipment, and Models for fluidized beds.(2,7)

The University of Jordan
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1st Semester – A.Y. 2025/2026

Course: **Chemical Reaction Engineering II – ChE0915422 (3 Cr. – Required Course)**

Instructor: Prof. R. Shawabkeh

Office: ChE114, Telephone: 06/5355000 ext 22892, Email: rshawabk@ju.edu.jo
Office Hours: Sun Tue Thu 10:00-11:00, 1:00-2:00 Mon Wed 11:00 - 1:00

Course website: http://elearning.ju.edu.jo

Catalog description: Design of unsteady-state, isothermal and non-isothermal reactors. Non-elementary reactions including Enzymatic, Polymeric, Photo and electrochemical reactions. Introduction to heterogeneous reactions, introduction to multiphase reaction systems. Non-catalytic fluid-solid reactions and reactors. The concept of rate controlling step. Catalysis and kinetic-catalytic models. Catalytic reaction mechanism, catalytic heterogeneous reactors packed and fluidized bed types. Thermal characteristics, the design of catalytic reactors, deactivation of the catalyst. Introduction to non-ideal reactors and residence time distribution.

Prerequisites by course: **ChE** **0905421** Chemical Reaction Engineering I (pre-requisite)

Prerequisites by topic: Students are assumed to have sufficient knowledge pertaining to the following: 1.Reaction Engineering

Textbook: **H. S. Fogler., 2006, " Elements of Chemical Reaction Engineering", 4th Ed., Prentice Hall, New Jersey**

References:

1. O. Levenspiel, Chemical Reaction Engineering, 3rd Ed. Wiley, 1999.
2. A. R. Cooper, G. V. Jeffreys, Chemical Kinetics and Reactor Design, Oliver and Boyd 1999.

Schedule: 32 lectures (50 minuets)

Course goals:

1. To Revise the Chemical Reaction Engineering concepts including temperature and pressure effects.
2. To introduce the design for heterogeneous reacting systems.
3. To define the solid catalyzed reactions.
4. To illustrate the deactivating catalysts. Mechanism, rate equation, rate equation from experiment, design.
5. To define the non-ideal flow

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student should: **[SO]**

1. Students should have revised the concepts of chemical reaction engineering concepts including what had been taken during Chemical Reaction Engineering I course. **[1]**
2. Students should be familiar with the definitions of rate equations, and contacting patterns **[1]**
3. Student should have good knowledge in the rate equation of the solid catalyzed reactions, its experimental methods for finding rates, the product distribution in multiple reactions, and its application to design **[1]**
4. Students are expected to be familiar with the definition of deactivating catalysts, its mechanism, its rate equation, and design **[1, 7]**
5. Students should be have a good knowledge about the non-ideal flow: Residence time distribution of flow in vessels, models for non-ideal flow, dispersion model, tanks in series model, multi parameter model, diagnosing ills of Operating equipment, and Models for fluidized beds. **[2, 7]**

Course topics:

		Hrs
1.	Review of chemical Reaction Engineering I	**2**
2.	2. Non-elementary Reactions	**5**
3.	3. Introduction to design for heterogeneous reacting systems	**7**
4.	4. Solid catalyzed reactions	**5**
5.	5. Deactivating catalysts	**2**
6.	Residence time distribution	**4**
7.	Non-ideal reactors	**5**
8.	Tests	**2**

Ground rules: Attendance is required and strictly enforced. To that end, attendance will be taken every lecture; Absence of more than 5hours will result in the expulsion of the student from the course.

Assessment & grading policy:

Assignments	5%	Quizzes		5%
First Exam	25%	Projects (SO-G,H)		0%
Midterm	25%	Lab Work		0%
Final Exam	40%	Presentation		0%
			Total	**100%**

Last Revised: Septemper 22, 2025