Jordan University of Science and Technology
Faculty of Engineering
Chemical Engineering Department

ChE 433: Chemical Reaction Engineering II

3 credit hour, 3 contact hour lecture, 3 credit hour Eng.

Instructor

Instructor: Dr. Mohannad Aljarrah E-mail**:** mtaljarrah@just.edu.jo

Textbooks & References

A. Textbook

	Textbook 1
Title	Elements of Chemical Reaction Engineering
Author(s)	H. Scott Fogler
Publisher	Prentice Hall International Inc
Year	2006
Edition	4th Edition

B. References

Books	1. Octave Levenspiel, "Chemical Reaction Engineering", 3rd Edition, John Wiley and Sons Inc., New York, 1998. 2. J. Smith, "Chemical Engineering Kinetics", 3rd Edition, McGraw-Hill, New York, 1981.
Journals	- Chemical Engineering Magazine (www.che.com) - International Journal of Chemical Reactor Engineering (www.bepress.com/ijcre)
Internet links	- http://www.just.edu.jo/~chemeng - http://www.engin.umich.edu/~cre/ - http://reactorlab.net/ - http://www.polymath-software.com/

Specific Course Information

A. Course Catalog:

Energy balance for ideal reactors. Non-isothermal reactor design. Stability of CSTRs. Non-ideal reactors and residence time distribution. Catalysis and catalytic reactions.

B. Prerequisites or co-requisites

CHE 431 Chemical Reaction Engineering I

C. Required/Elective or Selected Elective

Required

Objectives and Outcomes*

1) Size adiabatic and nonadiabatic CSTRs, PFRs, and PBRs [1,2]
2) Find number of reactors to obtain high conversions for highly exothermic and endothermic reversible reactions [1,2]
3) Determine Multiple Steady States (MSS) in a CSTR along with the ignition and extinction temperatures [1,2]

* Number in brackets refer to the Program outcomes

4) Analyze multiple reactions carried out in CSTRs, PFRs, and PBRs which are not operated isothermally in order to determine the concentrations and temperature as a function of position (PFR/PBR) and operating variables [1,2]
5) Define a catalyst, a catalytic mechanism and a rate limit step [1]
6) Use regression to discriminate between reaction rate laws and mechanisms [1]
7) Size isothermal reactors for heterogeneous reactions with Langmuir-Hinschelwood kinetics [1,2]
8) Discuss the different types of catalyst deactivation and the reactor types and describe schemes that can help offset the deactivation [1,2]
9) Analyze catalyst decay and conversion for CSTRs and PFRs with temperature-time trajectories, moving bed reactors, and straight through transport reactors [1,2]
10) Determine residence time distribution RTD [E(t), F(t)] and the mean residence time from tracer data [1,2]
11) Predict conversions from RTD data using the segregation model. [1,2]
12) Use software packages (e.g., Polymath and Matlab) to solve reaction engineering problems [7]

Contribution of Course to Meeting the Professional Component

Relationship to Student Outcomes (%)

1	2	3	4	5	6	7
30	40	20				10

Relationship to Chemical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
√	√	-	-	-	-

Topics Covered

Topics Covered		
Week	**Topics**	**Chapters in Text**
1-7	**Steady-State Nonisothermal Reactor Design:** The energy balance Nonisothermal continuous-flow reactors Equilibrium conversion Multiple Steady State Conditions Nonisothermal multiple reactions	Chapter 8
8-11	**Catalysis and Catalytic Reactors:** Catalysts Steps in catalytic reactions Synthesizing a rate law, mechanism, and rate-limiting step Design of reactors for gas-solid reactions Heterogeneous data analysis for reactor design	Chapter 10
12-15	**Distribution of Residence Times for Chemical Reactors:** Residence time distribution (RTD) function Measurement and characteristics of the RTD RTD in ideal reactors Reactor modeling with the RTD	Chapter 13