King Fahd University of Petroleum & Minerals
Department of Chemical Engineering

**CHE 402- Kinetics and Reactor Design (Term 081)**

**Instructor:** Dr. Eid M. Al-Mutairi
**Office:** 16-266
**Textbook:** Fogler, H. S., "Elements of Chemical Reaction Engineering", 4th ed., Prentice Hall (2005)
**Webpage:** http://webcourses.kfupm.edu.sa
**Reference:** Levenspiel, O., "Chemical Reaction Engineering", 3rd ed., John Wiley & Sons (1999).

**Overall Course Goal:**

The student should be able to:

1- Understand the concepts and principles of chemical reaction engineering and reactor design.
2- Develop and increase their lifelong learning skills in the solution of conventional industrial problems.
3- Analyze a given or a new process and reactor system through reasoning rather than memorization.

| **Overall Course Content:** | **Chapter** |
|---|---|
| 1- Addressing basic concepts of reaction kinetics:<br>Classification of chemical reactions.<br>Definition of rate of reaction.<br>The reaction rate constant. The reaction order.<br>Elementary reactions molecularity.<br>Reversible reactions. Non elementary reactions. | 1,3 |
| 2- Conversion and Reactor Sizing<br>The general mole balance equations.<br>Continuous steady-state flow reactors.<br>Industrial reactors.<br>Definition of conversion.<br>Reactor design equations.<br>Applications of the design equations: series/parallel connection. | 2 |
| 3- Isothermal reactor design:<br>Reactor sizing and design under stiochemetric table.<br>Design structure for isothermal reactors.<br>Design of CSTR's.<br>Tubular reactors.<br>Recycle reactors.<br>Semibatch reactors. | 4 |
| 4- Collection and Analysis of Rate Data:<br>Batch reactor design<br>Differential method of analysis<br>Integral method of analysis | 5 |

Method of initial rates
Method of half lives
Experimental design

5- Multiple reactions: 6
Conditions for maximizing the desired product in parallel and series reactions
The concept of fractional conversion in multiple reactions

6- Non-Isothermal Reactor Design: 8
The energy balance
Non-isothermal continuous flow reactors at steady state
Equilibrium conversion and adiabatic temperature
Optimum feed temperature
Multiple steady states

7- Catalysis and Catalytic Reactors: 10
Definition of catalysis and catalyst properties.
Steps in a catalytic reaction
Synthesizing a rate law, mechanism and rate limiting step.

**Organization:**

- Homework will be assigned periodically during the course.
- Attendance is very important. University regulations will be applied in this regard.
- Exams are **OPEN TEXTBOOK ONLY**.

**Grading Policy:**

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| Homework | 10% |
| Quizzes | 10% |
| Major Exams | 40% |
| Final Exam | 40% |