Prairie View A&M University
Chemical Engineering Department
CHEG 3063-P01: Kinetics and Reactor Design
Summer 2019 Syllabus

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COURSE INFORMATION

Meeting Time: MTWR 3:30-4:50 p.m. Location: Gilchrist Engineering Building 109

Prerequisites: CHEG 2053, MATH 4013, and CHEG 3053

Required Text: Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice-Hall, (5th Edition).

Evaluation: This course will utilize the following instruments to determine student grades and proficiency of the learning outcomes for the course. The course has been designed to ensure that students acquire a solid grounding in ABET Outcomes 1 and 2.

Description: Application of fundamental concepts of reaction stoichiometry, kinetics, and equilibria to the interpretation of reaction rate data. Application of reaction rate, heat, and mass transfer correlations to the design of batch, continuous tank, and tubular reactors.

Goals: The goal of this course is to teach students the science and design of reaction engineering processes.

1. Apply conservation laws.
2. Solve complex reaction engineering problems.
3. Design complex chemical reactors using modern calculation tools and techniques.

GRADING POLICY

ITEM	DESCRIPTION	%
HOMEWORK	BOOK PROBLEMS, OTHER WRITTEN ASSIGNMENTS,	25%
QUIZES	EVERY CHAPTER	10%
EXAM 1, EXAM 2, FINAL	BASED ON QUIZZES AND HOMEWORKS	50%
PROJECT	TEAM BASED; INDIVIDUALLY ASSESSED	15%

TESTS & TESTING POLICY

- In class exams are closed book. Formulas will be given.
- NO MAKE-UP EXAMS WILL BE GIVEN. A missed exam due to an excusable absence will not be added into the students Test Average; therefore, only three tests will count for that student.

- No electronic device will be allowed including iPads and eReaders.
- No graphing calculators are allowed for any test or quiz. Students must purchase a small scientific calculator to use on exams. A cell phone cannot be used as a replacement for a graphing calculator on an exam.
- No bathroom breaks are allowed during a test or a quiz. If a student leaves the room during this time, their exam/quiz will be collected and considered finished by the student.
- Any sightings of a cellular phone during an exam or a quiz will automatically result in a grade of zero for that student, and the student will be referred to the department head. Such meetings must take place within a week of the violation.

QUIZZES

- Closed-book quizzes will be given throughout the semester. Quizzes will be based on material covered in class and homework assignments.
- A quiz can be given in class or online using Taskstream or eCourses.

HOMEWORK POLICY & GUIDELINES

- Practice problems have been provided for students on the tentative lecture schedule. These problems are for your independent practice and not for weekly submission.
- Specific homework assignments will be given throughout the semester as the instructor examines the specific need of the class.
- These assignments may be computer based or involve the textbook.
- Students must submit these assignments during a given time frame.
- If a student chooses to disobey the university's honor code and copy the solution manual instead of submitting the student's own independent work, the student will receive a grade of zero on the assignment and will be referred to the department head. Such meetings must take place within a week of the infraction.
- All homework assignments must be submitted on engineering paper.
- Write only on the front of the paper (see example).
- Staple assignment if it is more than one page.
- Write your name, date, and assignment number on the front page.
- Number your pages! From time-to-time, students staple the pages out of order.
- Homework is due at the beginning of the class period. Late homework assignments will NOT be accepted!

CLASS ACTIVITIES AND PARTICIPATION GRADES

- Class activities will often occur each week.
- No late or replacement assignments will be accepted.
- These activities may be computer based or involve the textbook.
- Students must submit these assignments during a given time frame.

BOOK POLICY

- The textbook for this course is REQUIRED. Students without textbooks will eventually fail the course; therefore, all students without a hard copy (or special cases) of the textbook will be dropped from the course on the 7th class day based on the policy of the College of Engineering.
- Books can be purchased through the bookstore or online.

FINAL EXAM PROCEDURES

- The comprehensive final exam will be closed book. Any relevant references will be provided.
- All students are required to take the final exam. No exemptions are given.
- It is the student's responsibility to arrive on time for the exam with all of the needed materials.

TENTATIVE LECTURE SCHEDULE: Subject to change.

Week	Lecture Topic	# of lectures	Grading
1	Syllabus; Chapter 1: Mole Balances Chapter 2: Conversion and Reactor Sizing	4	HW, Quiz
2	Chapter 3: Rate Laws Begin Reports/Pick Groups	4	HW, Quiz
3	Chapter 4: Stoichiometry	3	Exam I, HW, Quiz
4	Chapter 5: Isothermal Reactor Design: Conversion	4	HW, Quiz
5	Chapter 6: Isothermal Reactor Design: Moles and Molar Flow Rates	3	Exam 2, HW, Quiz
6	Chapter 8: Multiple Reactions Chapter 9: Reaction Mechanisms, Pathways, Bioreactions, and Bioreactors	4	
7	Chapter 10: Catalysis and Catalytic Reactors	4	
8	Chapter 11 and 12: Nonisothermal Reactor Design	4	
9	Chapter 11 and 12: Nonisothermal Reactor Design Project Presentations	4	
10	Averages and Review for Final Final Exam SOS	3	Final Exam

COURSE OUTCOMES

Three major course outcomes will be assessed in this course using a number of performance criteria. The Course outcomes and their performance criteria are detailed below:

Course Outcome 1: This outcome is the same as program outcome 1. Students will have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

The two performance criteria used to assess this outcome consist of 1. Ability to identify and formulate reaction/reactor problems using the principles of mathematics, engineering, and science. Students are able to:

(i) Identify the limiting reactant, basis of calculation, and excess reactants.
(ii) Apply stoichiometric ratios or relative rates and develop a stoichiometric table based on phase and components.
(iii) Perform mole balances and energy balances based on chemical reaction and/or reactor type.
(iv) Understand reaction mechanisms and reaction pathways.
(v) Derive mole balance equation for various reactors.
(vi) Combine rate laws, mole balances, and stoichiometry to solve for volume, concentration, or flow rate.
(vii) Calculate pressure drops across tubular reactors using appropriate equations.
(viii) Calculate conversion and concentration using appropriate equations.

2. Ability to solve complex reaction engineering problems using graphing and computing tools. Given a problem, the student is able to:

(i) Determine the final exit concentration using Excel.

(ii) Calculate reactor volume using approximations.

(iii) Determine the optimum conversion based on graphs generated in Polymath.

Course Outcome 2: This outcome is the same as program outcome 2. Students will have an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

1. Ability to select appropriate reactor and operating conditions for safe and economic reactor operation. Given a problem, the student is able to:

(i) Evaluate the selectivity of products in reactions and choose feed location of raw materials.
(ii) Increase desired product for single and multiple reactants by selecting appropriate reactor and feed conditions.
(iii) Research common safety procedures utilized with different catalytic reactions.
(iv) Design for the control of runaway reactions and select other safety apparatus.
(v) Recognize the importance for safety and determine the risk associated with gas releases from reactors.

2. Ability to conduct a Review of Literature and determine preliminary design considerations.
   Students are able to:
   (i) Summarize information retrieved from journal articles and books.
   (ii) Provide useful information in a short memo.
   (iii) Write a full technical report of literature review without plagiarism.
   (iv) Calculation conversion or concentration of components entering and leaving reactor.
   (v) Determine the best method of producing a compound based on literature review.

3. Ability to perform detailed design of complex chemical reactors.
   Students are able to:
   (i) Determine the type of reactor and the phase of the reactants.
   (ii) Determine pressure drop and catalyst required for reaction at temperature and pressure specified.
   (iii) Determine reactor volume/length and catalyst weight required to meet specified need.
   (iv) Calculation composition or concentration of components entering and leaving reactor.
   (v) Meet design constraints given in the problem statement.
   (vi) Utilize computer software such as Excel, Aspen, Polymath and Hysys to determine the operating conditions necessary to meet specified need.