

Chemical Kinetics and Reactor Design

ECH4504

Class Periods: Tuesday and Thursday: 3:00 – 4:55 PM (T,R: Periods 8-9) **4 Credit Hours**

Locations: Little Hall (LIT) 121 (Tuesdays)
Rinker Hall (RNK) 110 (Thursdays)

Academic Term: Fall 2021

Instructor:

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352-392-0751

CHE 221

Office Hours: Mondays at 11 AM. Via zoom ([ufl.zoom.us/s/4509789118](https://ufl.zoom.us/j/4509789118)). (See below for more details).

Course Description (4 credits)

Homogeneous and heterogeneous reaction kinetic modeling and data analysis. Analysis and design of ideal batch, mixed, plug and recycle reactors. Heterogeneous catalysis and reactor design.

Course Pre-Requisites

Prereqs.: ECH 3264 and ECH 4123.

Course Objectives

- To learn the fundamentals of the chemical kinetics of homogeneous and heterogeneous reactions and reactor design.
- To develop and apply methods for designing chemical reactors and reaction processes.

Relation to Program Outcomes (ABET):

- Problem Solving: High
- Design: High
- Ethics: Medium
- Experimentation: Low
- Self-learning: Low

Required Textbooks and Software

- Elements of Chemical Reaction Engineering, H.S. Fogler, 5th Ed., ISBN: 0-13-388751-0
- International / fourth editions are acceptable.
- <http://www.umich.edu/~elements/5e/>

Course notes are not obtained from published resources.

Recommended Materials (Useful reading)

- *Chemical Reaction Engineering*, O. Levenspiel, 2nd Ed., Wiley (1972).
- *Chemical Engineering Kinetics*, J.M. Smith, 3rd Ed., McGraw-Hill (1981).
- *Chemical Kinetics*, K.J. Laidler, 3rd Ed., Harper Collins (1987).

Rough Course Schedule

We will try to have evening exams to allow for better social distancing and looser time constraints. I give 2-3 dates per exam in the schedule below as we will have to schedule the rooms in advance.

Date*	Day	Meeting	Topic	Homework
08/26	Thu.	Class 01	Motivation, Reaction Rates and Rate Equations	
08/31	Tue.	Class 02	Elementary & Complex Reactions	
09/02	Thu.	Class 03	PSSA (cont.) & Chain Reactions	HW 1 Due (1-2)
09/07	Tue.	Class 04	Catalysis & Adsorption	
09/09	Thu.	Class 05	Surface Reaction Kinetic Models	HW 2 Due (3-4)
09/14	Tue.	Class 06	Activation Energy and Potential Energy Surfaces	
09/16	Thu.	Class 07	General Mole Balance	HW 3 Due (5-6)
09/21	Tue.	Class 08	Conversion and Reactor Sizing	
09/23	Thu.	Class 09	Stoichiometric Relationships (<i>material on Exam 2</i>)	HW 4 Due (7-8)
09/28-09/29	Tue./Wed.	Exam 01	Evening periods E2-E3. Emphasizing Classes 1-8.	
09/30	Thu.	Class 10	Isothermal Reactor Design	
10/05	Tue.	Class 11	Tubular Reactors	
10/07	Thu.	Class 12	Reactions with Phase Change	HW 5 Due (9-11)
10/12	Tue.	Class 13	Pressure Drop in Reactors	
10/14	Thu.	Class 14	Multiple Reactions	HW 6 Due (12-13)
10/19	Tue.	Class 15	Solution Approach for Complex Rate Eqns	
10/21	Thu.	Class 16	Heat Effects in Chemical Reactions	HW 7 Due (14-15)
10/26	Tue.	Class 17	Heat Xfer to reactor	
10/28	Thu.	Class 18	Interstage heating or cooling	HW 8 Due (16-17)
11/02	Tue.	Class 19	<Flexible slot>	
11/04	Thu.	Class 20	Non-isothermal Tubular Reactors (<i>material on Exam 3</i>)	HW 9 Due (18-19)
11/09-11/10	Tue./Wed.	Exam 02	Evening periods E2-E3. Emphasizing Classes 9-19.	
11/11	Thu.	No Class	Veteran's Day	
11/16	Tue.	Class 21	Non-isothermal Tubular Reactors	
11/18	Thu.	Class 22	Non-isothermal Tubular Reactors	HW 10 Due (20-21)
11/23	Tue.	Class 23	Multiple reactions w/ Heat Effects	
11/25	Thu.	No Class	Thanksgiving	
11/30	Tue.	Class 24	Multiple Steady States	HW 11 Due (22-23)
12/02	Thu.	Class 25	Runaway Reactions	
12/07	Tue.	Class 26	Mass transport limitations.	HW 12 Due (24-25)
12/06-12/08	Mon.-Wed.	Exam 03	Evening periods E2-E3. Emphasizing Classes 20-26.	
12/16		Final Exam Slot	(10:00 AM – 12:00 PM) Unused if we don't fall behind.	

*This is based on a "regular" lecture schedule.

Office Hours

Mondays, 11:00 AM – 12:00 PM.

Office hours will be via zoom: ufl.zoom.us/j/4509789118

Irregular Office Hour Sessions

08/23: No office hours

08/30: Office hours will be 10:00 AM – 11:00 AM

09/06: No office hours (Labor Day)

09/07: Makeup office hours will be 11:00 AM – 12:00 PM

10/11: No office hours (Columbus and Indigenous Peoples' Day)

10/12: Makeup office hours will be 9:00 AM – 10:00 AM

11/05: Makeup office hours will be 3:00 PM – 4:00 PM

11/08: No office hours (AIChE)

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is strongly suggested.

Please refrain from the use of cell phones and laptops.

Excused absences are consistent with university policies in the undergraduate catalog and require appropriate documentation (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>).

Grading Policy

Homework problems will be graded on a 0-2 scale (0 = no effort, 1 = little effort, 2 = significant effort). *No credit will be given without work being shown.* If homework helps your performance in the class, it will be worth 15%, otherwise it will be worth 0% and your exam will solely be based on the exams. Final scores will be tabulated using the Table below.

Evaluation of Grades

Assignment	Percentage of Final Grade
Homework	0 or 15%
Exam w/ Best Grade	36 or 31%
Exam	32 or 27%
Exam	32 or 27%

Health and Wellness

You are expected to **wear approved face coverings at all times** during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS): Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>