

# Chemical Kinetics and Reactor Design

ECH 4504

**Class Periods:** Tuesday, Thursday, period 8-9 (3:00 pm – 4:55 pm)

**Location:** WM 0100

**Academic Term:** Fall 2018

## Instructor:

Name: Tanmay P. Lele

Email Address: [tlele@che.ufl.edu](mailto:tlele@che.ufl.edu)

Office Phone Number: 352 392 0317

Office Hours: Monday, 1:00 pm – 2:00 pm; Thursday, 11-12 am, Office: ChE 329. No office hours will be held on official holidays (March 2-9 and January 21)

## Teaching Assistants:

- There are no teaching assistants assigned this semester.

## Course Description

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 / Co-Requisites

ECH 3264 and ECH 4123.

## Course Objectives

Upon completion of this course, a student should be able to:

- Express reaction rate dependence on species concentrations and temperature
- Derive reaction rate equations given a sequence of elementary reactions
- Evaluate rate equations by testing them against experimental data
- Develop and apply material balances to size and analyze reactors
- Develop and apply energy balances to size and analyze reactors
- Analyze catalyst performance

## Required Textbooks and Software

- Title: Chemical reactions and chemical reactors
- Author: George W. Roberts
- Publication date and edition
- ISBN number: **9780470472651**
- Two copies of this book are on reserve at Marston Science library

## Tentative Course Schedule

Day	Week	Topic	Reading	HW assigned	HW due
T R	Jan 8 Jan 10	Course Overview, Extent of reaction Reaction rate laws	Ch. 1 Ch.2	#1	
T R T	Jan 15 Jan 17 Jan 22	Kinetics and thermodynamics Reactor design “	Ch.2 Ch. 3 Ch. 3 and 4	# 2 Part I	1
R T R	Jan 24 Jan 29 Jan 31	“ “ Multiple reactors	Ch. 4 “	#2 Part 2	#2 part 1 # 2 part 2
T R T	Feb 5 Feb 7 Feb 12	Exam 1 Multiple reactors Reaction mechanisms	Ch. 4 Ch. 4 Ch. 5	#3 #4	#3

R	Feb 14	Reaction mechanisms	Ch. 5		
T	Feb 19	“	Ch. 5	#5	# 4
R	Feb 21	Analysis of experimental data	Ch. 6		
T	Feb 26	“	Ch. 6		#5
R	Feb 28	Exam 2			
T	Mar 5	Holiday			
R	Mar 7	Holiday			
T	Mar 12	Design for multiple reactions	Ch. 7	#6	
R	Mar 14	“			
T	Mar 19	“	Ch. 7		
R	Mar 21	Energy balances in reactor sizing	Ch. 8		#6
T	Mar 26	“			
R	Mar 28	”	Ch. 8		
T	Apr 2	Exam 3			
R	Apr 4	Energy balances in reactor sizing	Ch. 8	#7	
T	Apr 9	“	Ch. 8		
R	Apr 11	Catalysis	Ch. 9		
T	Apr 16	“			#7
R	Apr 18	No lecture			
T	Apr 23	EXAM 4			

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

HW due dates are on the schedule and should be turned in in class, or worse case, in my mailbox by 5 pm. Late HW is docked 50% if it is a day late. HW \*will not\* be accepted beyond 24 hours after the due date (so 5 pm the following day). Include your name, date, and HW number on the first page. Write only on one side of paper and staple pages. Students are encouraged to help each other on HW, but copying someone else’s solution or allowing someone else to copy yours is cheating and a violation of academic honesty policy. Rule of thumb: Discuss the HW, but don’t look at anyone else’s work or show them your work. Homework solutions will be distributed in your mailboxes two days after the due date.

Quizzes will be given on Thursdays of non-exam weeks (except when there is no Thursday lecture, see schedule). The quizzes will generally cover lecture material from the previous few class periods and will require 10-15 minutes to complete. Quiz solutions will be provided. Quizzes are closed book, closed notes. Use of cell phones is not allowed during quizzes.

This statement is required: Excused absences must be consistent with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation. Additional information can be found here: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

### ***Evaluation of Grades***

Homework will be graded but will not count to the final grade unless it helps your grade. In that case, it will be worth upto 10% of the grade. Only one problem will be graded randomly on each homework. There is no final exam.

Table 1. If homework is counted toward final grade:

<b>Assignment</b>	<b>Percentage of Final Grade</b>
Homework	10%
Quiz	10 %
Exam w/ Lowest Grade	10%

The remaining three exams	70/3 % each
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Table 2. If homework is not counted toward final grade:

Assignment	Percentage of Final Grade
Homework	0%
Quiz	20 %
Exam w/ Lowest Grade	10%
The remaining three exams	70/3 % each

### **Grading Policy**

The final grade will be determined by scaling every score to the highest score, and then choosing cutoffs for grades A, A- and so on. The cutoffs are based on the instructor’s past experience teaching this course.

### **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/scrr/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.

### **Software Use**

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### **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>

### **Campus Resources:**

## Health and Wellness

### **U Matter, We Care:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto: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/>.

## Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.