

Chemical Kinetics and Reactor Design

ECH 4504 Class number: 12486

Department of Chemical Engineering

Class Periods: Tuesday, Thursday, period 7-8 (1:55 PM - 3:50 PM)

Location: LAR 0239

Academic Term: Fall 2019

Instructor:

Name: Tanmay P. Lele

Email Address: telle@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.

Supervised Teaching Student:

Please contact through the Canvas website

- Rachel Martin, r.martin@ufl.edu, Thursday, period 8, LAR 0239

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. 4 credit hours.

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

Materials and Supply Fees

None

Professional Component (ABET):

State the contribution of the course to meeting the professional components of the ABET-accredited degree.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	High
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	Medium
4. An ability to communicate effectively with a range of audiences	High

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Medium
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	Medium
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	

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**](#)

Course Schedule

Day	Week	Topic	Reading	HW assigned	HW due
T R	Aug 20 Aug 22	Course Overview, Extent of reaction Reaction rate laws	Ch. 1 Ch.2	#1	
T R T	Aug 27 Aug 29 Sep 3	Kinetics and thermodynamics Reactor design “	Ch.2 Ch. 3 Ch. 3 and 4	# 2 Part1	1
R T R	Sep 5 Sep 10 Sep 12	“ “ Multiple reactors	Ch. 4 “	#2 Part 2	#2 part 1 # 2 part 2
T R T	Sep 17 Sep 19 Sep 24	Exam 1 Multiple reactors Reaction mechanisms	Ch. 4 Ch. 4 Ch. 5	#3 #4	#3
R T R	Sep 26 Oct 1 Oct 3	Reaction mechanisms “ No lecture	Ch. 5 Ch. 5 Ch. 6	#5	# 4
T R T	Oct 8 Oct 10 Oct 15	Analysis of experimental data Exam 2 No lecture	Ch. 6		#5
R T R	Oct 17 Oct 22 Oct 24	No lecture Design for multiple reactions “	Ch. 7	#6	
T R T	Oct 29 Oct 31 Nov 5	“ Energy balances in reactor sizing “	Ch. 7 Ch. 8		#6
R T R	Nov 7 Nov 12 Nov 14	” Exam 3 No lecture	Ch. 8 Ch. 8	#7	
T R T	Nov 19 Nov 21 Nov 26	“ Catalysis “	Ch. 8 Ch. 9		#7
R	Dec 3	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.

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

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 up to 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:

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

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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing

staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

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 Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [**Office of Title IX Compliance**](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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. <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.

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