Chemical and Biomolecular Engineering 142
Chemical Kinetics and Reaction Engineering
Fall Semester 2016
Course Website: CBE 142 - FALL 2016 on bcourses.berkeley.edu

Instructor: Prof. Alexander Katz (233 Hildebrand Hall, 643-3248, askatz@berkeley.edu)
Office Hours: Mon 1:00 pm – 2:00 pm, Fri 2:00 pm – 3:00 pm; appointment.

GSIs: Ms. Haefa Mansour (276 Tan Hall, haefamansour@berkeley.edu)
Office Hours: Mon 12:00 – 1:00 pm, Bixby North
Fri 12:00 – 1:00 pm, 433 Latimer

Ms. Marianne Sleiman (376 Tan Hall, sleiman@berkeley.edu)
Office Hours: Mon 9:00 am - 10:00 am, 395 Tan Hall
Thu 9:00 am - 10:00 am, 395 Tan Hall

Mr. Abraham Beyene (492 Stanley Hall, beyene.abraham@berkeley.edu)
Office Hours: Mon 5:00 pm - 6:00 pm, Bixby North
Fri 9:00 am - 10:00 am, 425 Latimer Hall

First Discussion (AB): Monday, 4:00 pm – 5:00 pm, 385 LeConte
Second Discussion (MS): Wednesday, 1:00 pm – 2:00 pm, 106 Moffitt Library
Third Discussion (HM): Wednesday, 2:00 pm – 3:00 pm, B56 Hildebrand
Fourth Discussion (HM): Wednesday, 3:00 pm – 4:00 pm, 102 Latimer
Fifth Discussion (MS): Friday, 12:00 pm – 1:00 pm, 179 Stanley
Sixth Discussion (AB): Thursday, 4:00 pm – 5:00 pm, B51 Hildebrand

Lecture Hours: TuTh, 11:00 am – 12:30 pm, 4 LeConte

Text: H. S. Fogler, Elements of Chemical Reaction Engineering, 5th Edition, Prentice Hall, 2016.

Course Grade: The course grade will be determined by the following:

Homework:	5%
Design Projects:	5%
Midterm Exam 1:	25%
Midterm Exam 2:	20%
Final Examination:	45%

Homework: Homework will be assigned on Tuesdays and will be due at the beginning of lecture on the following Tuesday, unless indicated otherwise. Approximately three to five problems will be assigned each week (typically a subset of these will be graded). Solutions will be posted on the class website to this and prior homework.

Computer Use: The use of a numerical methods program for solving systems of ordinary differential equations and non-linear algebraic equations will be part of this course. GSIs will provide background for implementation of numerical methods in the beginning of the course. College of Chemistry facilities are equipped with both MathCad and Polymath, which are sufficient for the types of problems being addressed in this course.

Grading Policies:

1. Homework must be turned in at the designated time – **before lecture at 11:00 am**. Late problem sets will be corrected but assigned a score of zero.
2. Students should feel free to discuss the homework and design project assignment with others; however, **the final product must be entirely your own work**.
3. Although homework and design projects will not be regraded, requests for all homework/design project regrades can be made at the end of the course and will be taken into consideration when determining the final course grade.
4. Each student who submits a course evaluation by December 1, 2016 will have the **lowest four homework scores dropped** from their total score, when calculating the average homework course grade.
5. Exams will not be given early or late. If you miss an exam for a valid reason, your scores from other exams will be averaged to make up for the missed exam. Missing more than one exam will result in either an I or an F grade for the course. Missing an exam without a valid reason will result in a zero grade for that exam. Requests for exam regrades, if approved, will require the entire exam to be regraded (select portions will not be regraded).

References:

The following books have been placed on reserve in the Chemistry Library. These books are intended to complement lecture notes and the primary textbook.

Chemical Kinetics

K. J. Laidler, Chemical Kinetics, 3rd edition, Harper & Row, 1987. (2 copies)
J. W. Moore and R G. Pearson, Kinetics and Mechanism, 3rd edition, Wiley, 1981.
W. C. Gardiner, Jr., Rates and Mechanisms of Chemical Reactions, W. C. Benjamin, Inc., 1969.
M. Boudart, Kinetics of Chemical Processes, Prentice-Hall, 1968.

Reaction Engineering

H. S. Fogler, Elements of Chemical Reaction Engineering, 4th Edition, Prentice Hall, 2006.
H.S. Fogler, Essentials of Chemical Reaction Engineering, 2011,
Prentice Hall, Upper Saddle River, New Jersey.
O. Levenspiel, Chemical Reaction Engineering, 3rd edition, Wiley, 1999.
C. G. Hill, Jr., An Introduction to Chemical Engineering Kinetics and Reactor Design, Wiley, 1977. (3 copies)
J. M. Smith, Chemical Engineering Kinetics, 3rd edition, McGraw Hill, 1981. (2 copies)

Heterogeneous Systems and Catalysis

C. N. Satterfield, Mass Transfer in Heterogeneous Catalysis, MIT Press, 1970. (2 copies)
J. J. Carberry, Chemical and Catalytic Reaction Engineering, McGraw Hill, 1976. (2 copies)

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Fall Semester 2016 Class Schedule

	Date	Lecture Nº	Topic	Chapter
Aug	25	1	Introduction; Definition of reaction rate	Preface; 1
	30	2	General mole balances; Basic types of chemical reactors	1
Sept	1	3	Reactor design equations	2
	6	4*	Reactor design for single reactions; Multiple-reactor systems	2
	8	5	Chemical reactions with volume and phase changes; Isothermal reactor design	4; 5
	13	6*	Concepts in chemical kinetics	3
	15	7	Reaction rate laws; Mechanisms of homogeneous reactions	3; 9
	20	8*	Mechanisms of homogeneous reactions	9
	22	9	Examples of reaction mechanisms	9
	27	10*	Semibatch reactors	6
	29	11	Recycle and membrane reactors;	6
Oct	4	12*	Reactor energy balances	11
	6	--	**Midterm 1**	
	11	13	Reactor energy balances	11
	13	14	Design of non-isothermal reactors	11; 12
	18	15*	Multiple steady-states; Reactor stability and thermal runaway	12
	20	16	Unsteady-state nonisothermal reactors	13
	25	17	Design of reactors for multiple reactions; Series and parallel reactions	8; 13
	27	18*	Concepts in heterogeneous catalysis *Note: homework due off cycle*	10

Date		Lecture N^{o}	Topic	Chapter
Nov	1	--	**Midterm 2**	
	3	19	Mechanisms of surface-catalyzed reactions; Catalytic reactions	10
	8	20*	External transport effects in catalyst particles	14
	10	21	Intraparticle diffusion and reaction; Catalyst effectiveness factor	15
	15	22*	Catalyst effectiveness factor	15
	17	23	Nonisothermal catalyst particles	15
	22	24*	Nonisothermal catalyst particles	15
	24	--	Thanksgiving Holiday	
	29	25	Mass transfer and reaction in packed beds	15
Dec	1	26*	Criteria for transport limitations/Summary *Note: homework due off cycle*	15
	14	--	**Final Examination (8 AM – 11 AM)**	

* Denotes dates on which homework problem assignments are due unless other arrangements are announced