The University of Southern Mississippi
College of Science and Technology – Polymers and High Performance Materials

Course Syllabus - PSC 740
Polymer Kinetics and Reactor Design
Spring 2009

INSTRUCTOR: **Dr. Derek Patton**
Office: PSRC 312
E-mail: derek.patton@usm.edu
Office hours: by appointment
Course materials: www.usm.edu/pattonresearchgroup OR www.usm.edu/polymerkinetics

CLASS MEETING

8:00 – 9:15 a.m. Tuesday and Thursday
PSRC 105

TEXTBOOKS

Chemical Reaction Engineering, 3rd Edition, Octave Levenspiel
Polymer Chemistry, 2nd Edition, Hiemenz and Lodge
Laptop Computer
Mathcad 13 or 14

Other reference materials (recommended but not required): Contemporary Polymer Chemistry, 3rd Edition, H. R. Allcock et al.

I. COURSE DESCRIPTION

3 hrs. Polymer Science undergraduate students only. Introduction to polymerization kinetics and reactor design.

II. COURSE OBJECTIVES AND OUTCOMES

At the conclusion of this course the student should be able to:

1. Understand general chemical kinetics, analysis of kinetic data and analysis of complex reaction mechanisms.
2. Understand polymerization kinetics for major polymerization reactions including chain polymerization, anionic and cationic polymerization, condensation polymerization, emulsion polymerization and coordination polymerization.
3. Understand basics of chemical reactor design.
4. Evaluate kinetic data and determine potential mechanisms.
5. Effectively utilize MATHCAD software to analyze kinetic data.
6. Obtain an introductory understanding of controlled radical polymerization kinetics.

III. COURSE TOPICS

Reaction Classifications and Mechanisms
Rate Constants and Stoichiometric Relationships
Analysis of Kinetic Data
Michaelis-Menten Kinetics
Equilibrium and Ceiling Temperatures
Chain Polymerization Kinetics
Chain Transfer
Anionic and Cationic Polymerization Kinetics
Chain Copolymerization, Reactivity Ratios and Copolymer Microstructure
Condensation Polymerization Kinetics
Emulsion Polymerization Kinetics
Controlled Radical Polymerization Kinetics
Ideal Batch Reactors
Ideal Backmix Reactors
Plug Flow Reactors
Size Comparison of Reactors

IV. INSTRUCTIONAL METHODS AND ACTIVITIES

Class lectures and readings.
Individual and group activities and discussions.
Students must have a lap-top computer for the class with MATHCAD software.
Help sessions will be arranged outside of class at the request of students.

V. EVALUATION AND GRADE ASSIGNMENT

90 - 100%	= A
80 – 89.99	= B
70 – 79.99	= C
60 – 69.99	= D
0 – 55.0	= F

Students are expected to work all assigned problems. Students are encouraged to work together on homework problems.

Some exams may be given as take-home exams. Students are expected to work independently on all examinations.

The grade for the course will be determined as follows:

Problem sets (5)	25%
Written Assignment	15%
Exam 1	15%
Exam 2	15%
Final Exam	30%
Total	**100%**

VI. Course Communication

Announcements will be made during class and by e-mail. All students must provide a current e-mail address and check it frequently.

VII. ATTENDANCE AND OTHER COURSE POLICIES

Students are expected to attend every class and attend on time. Problem sets will be administered about every two weeks and cannot be made up. A student who misses a quiz or a major test will receive a grade of zero. A student with an excused absence will be able to make up a major test (The test may differ in format).

The excused or unexcused status of an absence will only be considered after **written notice** of the absence including the reason for the absence has been submitted to the instructor. This must be submitted no later than the first class attended after the absence. **No absence will be considered as excused without written notice.**

More than three (3) absences for any reason is considered to be excessive. If circumstances place the student in a situation that involves excessive absenteeism, the student should plan on dropping the class before the drop date or ask for a withdrawal from the class after the drop date. Unless special circumstances are involved, no work, including exams, can be made up if more than three absences are on record. Communication and the timing of the communication are keys to acceptable outcomes. Poor timing or no communication will result in an unacceptable outcome.

If cellular phones are brought to class, please switch them to inaudible or off. Do not try to answer a phone call while in the classroom. This behavior is distracting to others and can be disruptive. If you must respond to an anticipated emergency call, warn me that you may have to leave the classroom. **A cell phone that can be seen by the instructor during a quiz or test will be treated as a means to cheat and all applicable consequences related to academic dishonesty will be enforced.**

Class participation: Students are expected to be prepared for class and to respond to questions from the instructor. Reading the material in the text, working problems, listening in class, and studying notes should prepare the student for answering the questions.

VIII. ACADEMIC HONESTY

When cheating is discovered, the faculty member may give the student an F on the work involved or in the course. If further disciplinary action is deemed appropriate, the student should be reported to the dean of students. In addition to being in violation of academic honesty, cheating violates the code of student conduct and may be grounds for probation, suspension, or expulsion, or all three. Students on disciplinary suspension may not enroll in any courses offered by The University of SouthernMississippi.

IX. AMERICANS WITH DISABILITIES ACT STATEMENT

If a student has a disability that qualifies under the American with Disabilities Act(ADA) and require accommodations, he/she should contact the Office of Disability Accommodations(ODA) for information on appropriate policies and procedures. Disabilities covered by ADA may include learning, psychiatric, physical disabilities, or chronic health disorders. Students can contact ODA if they are not certain whether a medical condition/disability qualifies. Box 8586; Telephone (601) 266-5024; TYY (601) 266-6837; Fax (601) 266-6035.

Class Schedule*

PSC 740 Kinetics, Spring 2008			
Date	Day	Subject	Comments
1/13	Tu	Introduction to Kinetics, Rates and Rate Laws	Ch. 1 Levenspeil
1/15	Th	Elementary Reactions	Ch. 2 Levenspeil and notes
1/20	Tu	Reaction Mechanisms – SSA and Pre-equilibrium	
1/22	Th	Specific Mechanisms – Michaelis-Menten	
		Help session for Problem Set 1, Thursday or Friday	
1/27	Tu	Temperature Dependence – Arrhenius Relation	Ch. 2 Levenspeil **Problem Set 1 due**
1/29	Th	Collision and Transition State Theories, begin analysis	Ch. 3 Levenspeil
2/3	Tu	Analysis of Kinetic Data	**UG EXAM (Take Home)**
		The section above is optional for graduate students	
2/5	Th	Equilibrium and Ceiling Temperatures	Ch. 10 Allcock
2/10	Tu	Condensation Polymerization	Ch. 2 H&L, Ch. 11 Allcock
2/12	Th	Condensation (cont)	
2/17	Tu	Condensation (cont)	**Problem Set 2 due**
2/19	Th	*No Lecture*	*Waterborne Symposium*
2/24	Tu	*No Lecture*	*Mardi Gras Holiday*
2/26	Th	Free Radical Polymerization	Ch. 3 H&L, Ch. 12 Allcock
3/3	Tu	Free Radical (cont)	
3/5	Th	Free Radical (cont)	
3/10	Tu	Free Radical (cont)	Ch. 12 Allcock **Problem Set 3 due**
3/12	Th	**EXAM 1 (In Class)**	
3/17	Tu	*No Lecture*	*Spring Break*
3/19	Th		
3/24	Tu	*No Lecture*	*ACS Meeting*
3/26	Th	Ionic Polymerization	Ch. 4 H&L, Ch. 13 Allcock
3/31	Tu	Ionic Polymerization (cont)	
4/2	Th	Ionic Polymerization (cont)	
4/7	Tu	Ionic/Emulsion Polymerization	**Problem Set 4 due**
4/9	Th	Emulsion (cont)	**EXAM 2 (take home)**
4/14	Tu	Introduction to Reactor Design	Chs. 4 & 5 Levenspiel
4/16	Th	Ideal Batch and Batchmix Reactors	Ch. 5 Levenspiel
4/21	Tu	Plug Flow Reactors	
4/23	Th	Size Comparison of Reactors	Ch. 6 Levenspiel
4/28	Tu	Size Comparison of Reactors (continued)	
4/30	Th	Parallel Reactions	Ch. 7 Levenspiel, **Problem Set 5 due** Last Day of Class
5/5		Finals Week	

*Schedule may be revised if necessary. Students will be notified if this is the case. Mandatory attendance for graduate students begins 2/5/2009.