ChEE 530: Advanced Chemical Reaction Engineering

Class meeting time: Time TBD in Spring 20xx (Instructor: Farhang Shadman)

Pre-requisites (or with approval of instructor): graduate level Transport Phenomena (ChEE 505) and Thermodynamics (CHEE 506).

Attendance policy: not required but essential since problem-solving time is run in class at the end of each topical chapter.

Grading policy: 20% for homework and participation in problem-solving practice in class; 50% for midterms (at least two mid-terms); 30% for the final exam. If any midterms test is missed (prior notice and approval), the weight of that test will be transferred to the other midterms (no make-up tests).

Homework assignments: at least 2 problems per week

Office-hour policy: 1 hour after each class or by appointment; questions by email are also encouraged.

Course Content:

1. Review of fundamentals of chemical reaction engineering
2. Review of fundamentals in design of ideal reactors
3. Non-ideal chemical reactors:
    a. Differences between ideal reactors and non-ideal reactors
    b. Characterization of flow non-ideality and mixing
    c. Residence Time Distribution (RTD) concepts and applications
    d. Segregated-flow reactors
    e. Non-segregated flow reactors
    f. Non-ideal reactor models (laminar, mixing cell, and dispersion models)

*** First Midterm Test*

4. Fundamental of heterogeneous reacting systems

5. Comparison of catalytic and non-catalytic reacting systems
6. Review of concepts of catalysis
7. Brief history of most important industrial catalytic reactions and processes
8. Characterization of porous media (pore- size, geometric vs. intra-phase surface area, various definitions of density and porosity)
9. Por-Size Distribution (PSD) definition and characterization
10. Mass and heat transport in porous media

*** Second Midterm Test*

11. Interactions of mass and heat transfer with chemical reactions
12. Concepts of Effectiveness Factor
13. Derivation and application of key dimensionless parameters including Thiele modulus, Damkohler number, and Prater number.
14. Inter-phase transport influenced reactions
15. Intra-phase transport influenced reactions
16. Combined and inter and intra-phase transport influence on reactions
17. Reactor design for heterogeneous reacting systems
18. Fixed bed and fluidized-bed reactors
19. Non-catalytic heterogeneous reacting systems
20. Novel reactor systems used in environmental and high technology manufacturing fields.

*** Final Exam*

Text Book and References

There will be no required textbooks. Copies of handouts and reference materials will be provided to students.

Accommodations

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to

contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit http://drc.arizona.edu.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

UA Nondiscrimination and Anti-Harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.