CHE 504 - Advanced Chemical Reactor Design

Note: Most of the course material will be distributed via the WWW. The ChE Courses Website
http://elearning.csuohio.edu/ [Blackboard LEARN]
can be accessed through the CSUnet network
http://www.csuohio.edu > MyCSU > Blackboard > CHE 504
Only a limited number of documents will be distributed as hand-outs, the remaining documentation can be downloaded and/or printed.

Instructor:	Jorge E. Gatica	SH 459	Ph: 523-7274
Teaching Asst.:	TBA	SH 444	Ph: 687-2569
Lectures:	MW 4:00 - 5:50 PM	SH 125	
Office hours:	MW 1:00 - 2:00 PM or by appointment	SH 459	j.gatica@csuohio.edu (*)
Recitations:	N/A		

Office hours *are as indicated. However, should you need extra help, please contact me (*), and I'll schedule extra office hours.*

Course Objective:

Review of Basic Principles of Chemical Reaction Engineering. Basic Flow Models. Introduction to Stability of Chemical Reactors, Bifurcation Analysis of Reaction Systems. Non Elementary Homogeneous Reaction Systems. Introduction to Combustion and Analytical Methods in Combustion.

Textbook:

Fogler, Scott H. "Elements of Chemical Reaction Engineering," 4th Ed., Prentice Hall, Englewood Cliffs, NJ (2005).

Supplementary Reading:

- Levenspiel, Octave "Chemical Reaction Engineering," 3rd Ed., Wiley, New York, NY (1999).
- Schmidt. Lanny D. "The Engineering of Chemical Reactions," Oxford University Press, Inc., New York, NY (1998).

Note: Copies of these books should be available through CSU Libraries (and OhioLink)

Grading Policy: The final grade will be a combination as follows,

- **Two (2) Mid-term *(Take-home/ In-class)* Exams (2 × [10% / 15%]):** The course has been scheduled into three sections, an exam will be given at the end of each sections. These exams will be given following a dual format involving in-class and outside-of-the-classroom activities.
- **An Open Ended Project (OEP) (15%, +10% extra-credit):** A Reactor Design Problem has been formulated based on an actual Industrial Process. The project is assigned as a "Plant Problem," for which students must decide on a strategy to solve the problem. Its solution will require completing the specifications/data provided, implementing a

Simulation Module using a Process Design & Analysis Software (ASPEN Plus), and proposing an operation/design strategy to meet a given Design Assignment. An interim report will be requested at the time of the assignment, and a final report with approach, results, and recommendations will be due by week 14 (two weeks before final). The grades will be determined by a combined score for creativity, technical quality, engineering considerations, ability to meet deadlines, "budget" and "time" management, and the organization/presentation of the report. OEP assignments will be a team-assignment.

- **Homeworks/Class Participation (10%):** will be assigned weekly, solutions will be reviewed in class each week [a selected, or "team," group of students will "solve" the problems in class along with the instructor]. Programming solutions will available in the CHE 504 Web Site.
- **A Final (*take-home)* Exam (25 %):** At the end of the third section (emphasis on the last section of the course).

Note: The open-ended project, the take-home assignments, and the Final Exam, will require the **use of a computer**. Therefore, I would recommend to every student to become familiar with an elementary ODE/AE Solver and Process Simulators, most of the problems will require MS Excel, MatLAB and/or AspenONE (ASPEN One Plus). Licensed personal copies can be obtained on-line (or through the bookstore) for a nominal fee. These software packages are installed in the ChE Computer Laboratory (SH441) and the Engineering College Labs (SH 127/125). In addition, AspenONE can be installed in personal computers and used free of charge within the CSUNet environment [platforms need to have access to the license server].

Introductory and Review sections on MatLAB and ASPEN One Plus have been already planned as part of the class schedule.

MatLAB (http://www.mathworks.com/): Is a general-purpose solver, similar to TK Solver or PolyMath. Some of the textbook examples have been worked out using PolyMath, the equivalent MatLab "m"(etafiles) will be available through the CHE 404 Website (some are also available in the CD). Some of the homework assignments will follow the same format.

Although a full copy of the source code needed to install PolyMath is provided in the CD that accompanies the textbook, PolyMath will not be used in this course. The College has licensed free copies for faculty and students [to be installed in personal Laptops, or home desktops; link provided in Bb]

AspenONE Plus (AspenTech), (http://www.aspentech.com/): A general-purpose process simulator and the "standard" in the Chemical Process Industry (CPI): *"AspenONE is the market-leading application suite enables process manufacturers to implement best practices for optimizing engineering, manufacturing, and supply chain operations."* It consists of a large suite of steady-state and dynamic process analysis, simulation, and evaluation. Two of the main applications: AspenONE and HySyS, will be introduced and illustrated throughout CHE 404. This software will be particularly useful for the OEP-IDE [Final Project]. **Copies of ASPEN Plus can be installed in personal computers, but can be used only within CSUNet.**