ChE 433/ Met 433: Process Control          Spring 2006

Classroom: C-303
Day/Time of course: MWF 12:00-12:50 p.m.
Instructor: Dr. Stan Smith
Course URL: http://www.hpcnet.org/sdsmt/directory/courses/2006sp/che43301
E-mail: stanley.smith@sdsmt.edu or stanleysmith@bhsu.edu
Phone: MWF TBD TTh 642-6076
Office: EEP-221
Office Hours: MF 10:00 – 10:50; W 1:00 – 2:00
Appointments outside of office hours, schedule via email or after class
Prerequisite: Math 321 and senior standing
Special Needs: Students with special needs or requiring special accommodations should contact the instructor and/or the campus ADA coordinator, Jolie McCoy at 394-1924 at the earliest opportunity.
Catalog Description: (3-0) 3 credits. Prerequisite: MATH 321 and senior standing. Analysis and design of process control systems for industrial processes, including controller tuning and design of multi-variable control schemes. This course is cross-listed ChE/MET 433.
Course Objectives: The objective of this course is to provide students with a working knowledge required to understand and solve practical problems which require:
1. Process dynamic analysis;
2. Basic process-control theory

Instructional Methods: This course utilizes lectures, reading assignments, class exercises, homework problems, case studies, quizzes and examinations as methods of instruction and assessment.

Student Learning Outcomes

After completion of this course the average student is expected to be able to:

1. Model the dynamic behavior of physical processes and automatic control systems using algebraic and differential equations, and by using block diagrams representing the LaPlace transforms of those equations.
2. Tune feedback controllers to produce a desired mode of response.
3. Identify and sketch graphs illustrating overdamped, critically damped, underdamped, undamped and unstable systems, and predict which response will occur based on the transfer functions describing a system.
4. Model complex process behavior using empirical first-order-plus-dead-time models, and tune automatic controllers based on those process models.
5. Illustrate control techniques and response modes using Control Station simulation software.
6. Explain advanced control techniques of feed-forward and cascade control using block diagrams, process and instrumentation diagrams, and time-domain graphs.
7. Explain and use concepts of statistical process control, including statistics of central tendency and variability, control charts, and hypothesis testing.

Evaluation Procedures
You are responsible for your own education. Specific responsibilities that I request include: 1) show up for class on time, 2) read the appropriate materials both from the text, 3) prepare questions for class and participate in class discussions, 4) submit homework, projects, and exams of professional quality. To be of professional quality, work should be neat and legible, presented in logical manner, should include a carefully sketched drawing where appropriate, and should be grammatically correct and devoid of spelling errors. Assignments and exams will be graded for technical correctness, as well as for professional quality. Final letter grades will be based directly on the total points earned in the course. The available points in the course are as follows:

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<tr>
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<tbody>
<tr>
<td>Quizzes (best 5)</td>
<td>20 pts each</td>
<td>100</td>
<td>20% of grade</td>
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<tr>
<td>Unit Exams (2)</td>
<td>100 pts each</td>
<td>200</td>
<td>40% of grade</td>
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<tr>
<td>Final Exam</td>
<td>150 pts</td>
<td>150</td>
<td>30% of grade</td>
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<tr>
<td>Homework</td>
<td>50 pts</td>
<td>50</td>
<td>10% of grade</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>500 points</strong></td>
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Final Letter grades will be assigned based on each student’s total points earned in the course as follows:

- A 450-500 points
- B 400-449 points
- C 350-399 points
- D 300-349 points
- F - Less then 300 points
- W Last day for withdrawing from course: April 7, 2006

Cheating and Plagiarism policy: Unless assignments are specified as being team assignments, individual work is expected. This is not meant to preclude students helping each other, but outright copying is not allowed and will be penalized. Quizzes or exams are always to be completed individually. Cheating on quizzes or exams will be penalized with penalties up to failure of the course.

Absences
a) Students who miss a class should arrange to get notes from one of their classmates.
b) Excused absences are allowed for verifiable illness, emergencies, and school-sponsored activities. Students anticipating an excused absence should contact the instructor as early as possible.
c) Students who expect to miss a class should submit assignments that are due prior to the absence.
d) Students who miss an exam for an excused absence will be given a make-up exam; students must arrange a time for the make-up exam prior to the in-class exam.

Homework: Homework problems will be assigned and may or may not be collected. Please have your homework ready to turn in at the beginning of class. Late homework will be accepted with a 50% penalty until 4:00 p.m. the same day.

Tentative Schedule:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Exam</th>
<th>Topics</th>
<th>Text Chapters</th>
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<tbody>
<tr>
<td>1</td>
<td>12-Feb</td>
<td>Mathematical Tools, 1st-Order Systems, Basic Components of Control Systems</td>
<td>1, 2, 3, 5</td>
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<tr>
<td>2</td>
<td>10-Apr</td>
<td>Higher-Order Systems, Single-Loop Control Systems, Tuning Feedback Controllers</td>
<td>6, 7</td>
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<tr>
<td>3</td>
<td>8-May</td>
<td>Cascade Control, Feedforward Control, Statistical Tools</td>
<td>9, 11, Handouts</td>
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