CBE 333
Process Measurements and Control
South Dakota School of Mines and Technology
(1 credit)

Fall 2012
C303 Chemistry and Chemical Engineering Building
Mondays, Wednesdays, and Fridays, 9:00 – 9:50 am

Instructor: Dr. Kenneth M. Benjamin
C-218 Chemistry and Chemical Engineering Building
Kenneth.Benjamin@sdsmt.edu
394-2636

Office hours: Wednesdays 10 – 11 am
Thursdays 3 – 4 pm
By appointment


Website: TBA

Catalog Description:
(1-0) 1 credit. Prerequisite: CBE 218 or permission of instructor. A study of the equipment and techniques used in monitoring process measurements and the design of feedback control systems.

Course Objectives:
The objective of CBE 333 is to introduce students to the terminology, concepts and practices of process measurements, valve sizing, and automatic process control.

Expected Outcomes: After completion of this course, students are expected to be able to:
1. To configure simple feedback control loops, and identify the components of those loops.
2. To draw process and instrumentation drawings (P&ID’s) using standard ISA notation.
3. To determine the correct action of a feedback controller
4. To recognize feedback, feedforward, cascade and ratio control modes and for each will be able to: a) Draw the P&ID from a Process Flow Diagram and from a verbal or written description of the control desired, b) Draw a simplified block diagram form a P&ID.
5. To use the P-only control equation to compute gains, proportional bands, or other control variables.
Expected Outcomes (continued):
6. To describe the action of ON-OFF, proportional, and proportional-integral controllers.
7. To understand calibration curves and be able to prepare such curves from calibration data. Will be able to compute the gain of a transmitter and can compute either the output of a transmitter at a given input value or the input value at a given output value.
8. To understand and be able to implement basic field-tuning techniques for feedback control loops.
9. To describe the different types of control valves, and can identify the types by their inherent flow curves.
10. To compute flow rates through control valves from valve equations.
11. To identify sensors for temperature, pressure, and flow and will have a working understanding of how they operate.

Grading:

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<th>Item</th>
<th>Points</th>
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<td>Quizzes (3)</td>
<td>45</td>
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<td>Final Exam*</td>
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<td>Homework**</td>
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* The Final will be a comprehensive exam. All exams and quizzes will be open textbook and open notes.

** Homework turned in late will be subject to 10% deduction daily. Submitted homework must be clean, readable and logically sound.

Final Exam: Schedule Time – December 14, 2012, 10 am – 12 pm
Proposed Time – October 12, 2012 (Time and Place TBD)

Tentative Topics to Be Covered:
- Introduction to feedback control
- Terminology, sensors, transmitters, elements
- Types of control (On/Off, P, PI, PID)
- Tuning of feedback control loop
- PID Controllers and actions
- Block diagrams
- Introduction to advanced control schemes (cascade, ratio, feedforward)
- Final control elements (control valves)
- Valve characteristics, sizing

ADA Statement: Students with special needs or requiring special accommodations should contact Professor Benjamin and/or the campus ADA coordinator, Jolie McCoy, at 394-1924 at the earliest opportunity.
**Freedom in Learning Statement:**

Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the dean of the college which offers the class to initiate a review of the evaluation.

**Electronic Devices Policy:** Please turn off your cell phone before class starts. No text messaging in class. No headphones. If you wish to use a laptop in this class for purposes of note taking, that’s great; however, you will be required to download DyKnow software and then join ENGL350 to activate. Any attempt to circumvent the DyKnow monitoring system will be considered a form of cheating and a breach of academic integrity. Note that according to “Policy Governing Academic Integrity” in the SDSM&T Undergraduate Catalog, the instructor of record for this course has discretion of how acts of academic dishonesty are penalized, subject to the appeal process, and that “Penalties may range from requiring the student to repeat the work in question to failure in the course” (72-73). No other use of any other electronic/computer media is allowed during class time.

**Academic Integrity:** Students are expected to abide by the SDSMT policies of academic integrity (with regard to cheating, plagiarism, etc.), as outlined in the Course Catalog.

**Relation of Course Outcomes to Program Outcomes (2011-):**
The following table indicates the relative strengths of each course outcomes in addressing the program outcomes (on a scale of 1 to 4 where 4 indicates a strong emphasis).

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<th>CBE 333</th>
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*For a list of Program Objectives and Program Outcomes, please go to [http://cbe.sdsmt.edu/undergraduate](http://cbe.sdsmt.edu/undergraduate)*