Proposal Form For Addition And Revision Of Courses

1. Proposing College / School: Samuel Ginn College of Engineering
   Department: Chemical Engineering

2. Course Prefix and Number: CHEN 4170
   3. Effective Term: Fall 2012

4. Course Title: DIGITAL PROCESS CONTROL
   Abbreviated Title (30 characters or less): DIGITAL PROCESS CONTROL

5. Requested Action:
   - [ ] Renumber a Course
   - [ ] Add a Course
   - [ ] Revise a Course

6. Course Credit:
   Contact/Group Hours: 3
   Scheduled Type (e.g.: Lab, Lecture, Practicum, Directed Study):
   Weekly or Per Term?: Weekly
   Credit Hours: 3
   Anticipated Enrollment: 80
   Maximum Hours (Repeatability): 3

7. Grading Type:
   - [ ] Regular (ABCDF)
   - [ ] Satisfactory/Unsatisfactory (S/U)
   - [ ] Audit

8. Prerequisites/Corequisites:
   Use "P:" to indicate a prerequisite, "C:" to indicate a corequisite, and "P/C:" to indicate a prerequisite with concurrency.
   CHEN 3650 Min Grade of C

9. Restrictions: List specific restriction in space above.
   - [ ] College
   - [ ] Major
   - [ ] Standing
   - [ ] Degree

10. Course Description:
    (20 Words or Less; exactly as it should appear in the Bulletin)
    Introduction of basic concepts and principles for control system. Analysis of open loop and closed-loop processes using transfer functions.

11. May Count Either
    - [ ] Program Type
    - [ ] Program Title
    (Indicate if this particular course cannot be counted for credit in addition to another)

12. Affected Program(s):
    (Respond "N/A" if not included in any program; attach memorandum if more space is required)
    - Program Type
    - Program Title
    - Requirement or Elective?
    N/A

13. Overlapping or Duplication of Other Units' Offerings:
    (If course is included in any other degree program, is used as an elective frequently by other unit(s), or is in an area similar to that covered by another college/school, attach correspondence with relevant unit)
    - [ ] Applicable
    - [ ] Not Applicable
14. Justification: Requesting change in distribution of hours. Previously offered with 2 Lec., 1 Lab. The lab component has been absorbed into the lecture content. (Include a concise, yet adequate rationale for the addition/revision of the course, citing accreditation, assessments (faculty, graduate, and/or external) where applicable)

15. Resources: Not Applicable
(Indicate whether existing resources such as library materials, classroom/laboratory space, and faculty appointments are adequate to support the proposed addition/revision; if additional resources are required, indicate how such needs will be met, referencing the appropriate level of authorization -- i.e.: Dean -- where necessary; if no additional resources or shifting of resources will be necessary, respond "Not Applicable")

16. Student Learning Outcomes: See attached
(State in measurable terms (reflective of course level) what students should be able to do when they have completed this course)

17. Course Content Outline: See attached
(Provide a comprehensive, week-by-week breakdown of course content, including assignment due dates)

18. Assignments / Projects: See attached
(List all quizzes, projects, reports, activities and other components of the course grade -- including a brief description of each assignment that clarifies its contribution to the course's learning objectives)

19. Rubric and Grading Scale: See attached
(List all components of the course grade -- including attendance and/or participation if relevant -- with point totals for each; indicate point totals and ranges or percentages for grading scale; for S/U grading, detail performance expectations for a passing grade)

20. Justification for Graduate Credit: Not Applicable
(Include a brief statement explaining how the course meets graduate educational standards (i.e.: rigorous standards for evaluation, development of critical thinking and analytical skills, etc.))
(Included below are standard statements regarding course policies. If necessary, a statement may be altered to reflect the academic policies of individual faculty members and/or the academic unit or department, provided that there is no conflict with the Tiger Cub, Faculty Handbook, or any existing university policy.)

POLICY STATEMENTS

Attendance: Although attendance is not required, students are expected to attend all classes, and will be held responsible for any content covered in the event of an absence.

Excused Absences: Students are granted excused absences from class for the following reasons: illness of the student or serious illness of a member of the student's immediate family, the death of a member of the student's immediate family, trips for student organizations sponsored by an academic unit, trips for university classes, trips for participation in intercollegiate athletic events, subpoena for a court appearance, and religious holidays. Students who wish to have an excused absence from class for any other reason must contact the instructor in advance of the absence to request permission. The instructor will weigh the merits of the request, and render a decision. When feasible, the student must notify the instructor prior to the occurrence of any excused absences, but in no case shall such notification occur more than one week after the absence. Appropriate documentation for all excused absences is required. Please see the Tiger Cub for more information on excused absences.

Make-Up Policy: Arrangement to make up a missed major examination (e.g.: hour exams, mid-term exams) due to properly authorized excused absences must be initiated by the student within one week of the end of the period of the excused absence(s). Except in unusual circumstances, such as the continued absence of the student or the advent of university holidays, a make-up exam will take place within two weeks of the date that the student initiates arrangements for it. Except in extraordinary circumstances, no make-up exams will be arranged during the last three days before the final exam period begins.

Academic Honesty Policy: All portions of the Auburn University student academic honesty code (Title XII) found in the Tiger Cub will apply to university courses. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

Disability Accommodations: Students who need special accommodations in class, as provided for by the Americans With Disabilities Act, should arrange for a confidential meeting with the instructor during office hours in the first week of classes (or as soon as possible if accommodations are needed immediately). The student must bring a copy of their Accommodation Letter and an Instructor Verification Form to the meeting. If the student does not have these forms, they should make an appointment with the Program for Students with Disabilities, 1288 Haley Center, 844-2096 (V/TT).
CHEN 4170 - DIGITAL PROCESS CONTROL (3)
Required Core Course

2011-2012 Catalog Data   Lec (3). Introduction of basic concepts and principles for control system. Analysis of open loop and closed-loop processes using transfer functions.

Prerequisites   Pr: Completion of CHEN 3650 with a grade of C or better.

Schedule   Three one-hour class sessions per week

Course Objectives   This course is designed to teach students how to use digital controllers in the chemical process industry and design man-machine interfacing programs.

Textbooks
Seborg, Process Dynamics and Control, 2e, 2003, 9780471000778, John Wiley & Sons

Lecture Topics:
1. Introduction of dynamic processes and control systems (1 week)
2. Mathematical modeling and transfer functions (2 weeks)
3. First order systems (1 week)
4. Second order and complex systems (2 weeks)
5. Empirical modeling (1 week)
6. PID controllers (1 week)
7. Control instrumentations (1 week)
8. Closed-loop system (2 weeks)
9. Stability analysis (1 week)
10. Controller tuning (1 week)
11. Advanced control topics (1 week)
12. Exams (3) (1 week)

Course Outcomes: Upon successful completion of this course, students should be able to:
1. Derive first principles dynamic models for a given system with low to intermediate complexity, and derive the transfer function based on the ODEs. Identify the manipulated variables, controlled variables, and disturbance variables for the system. Develop a block diagram for the system under consideration.
2. Distinguish feedback and feed forward controllers; describe their advantages and disadvantages; classify the type of a given control system (i.e., feedback, feed forward or combined); describe basic properties of ratio control and cascade control.
3. Analyze the properties of a dynamic system based on its transfer function (such as stability, steady-state bias, oscillation) by performing partial fraction expansion to compute the output response for systems with different, repeated and conjugate roots. Construct the Bode plot of a given system.
4. Convert a given transfer function between its standard form, pole/zero form and gain/time constant form. Predict and analyze the system step response based on its poles, zeros and steady-state gain.
5. Approximate a higher-order system using a first-order-plus-time-delay model; estimate the model parameter (i.e. delay time, time constant and steady state gain) based on the system’s step-response.
6. State the generic transfer functions of different components in a control loop (i.e., actuator, sensor, transducer, controller, process) and simplify them appropriately for a given system.
7. State the transfer function of different control modes (i.e., proportional, integral and derivative) and describe their basic properties.
8. Choose among different types of actuator (air-to-open vs. air-to-close), different types of controllers (reverse vs. direct) for a given system based on safety and stability considerations.
9. Derive closed loop transfer functions based on a given block diagram. Analyze closed-loop system behavior and determine the range of stability using Routh arrays.

10. Design an optimal controller for a given system (including selecting desired closed-loop performance, performing controller tuning, and validating the designed control system using Matlab Simulink).

11. Prepare a technical report that summarizes the optimally designed control process.

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<tr>
<th>Contribution of Course to Meeting ABET Criteria 5 (Curriculum)</th>
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<tbody>
<tr>
<td>Math and Basic Sciences</td>
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<td>0 Credits</td>
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<th>Relationship of Course to Program Outcomes (PO's)</th>
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<tr>
<td>Program Outcome</td>
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<td>Level of Coverage</td>
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Date of Preparation and Person(s) Preparing This Description
October 12, 2011: Jin Wang