Syllabus
Engineering Technology
University of North Texas
Course Title: Control Systems
Course Prefix and Course Number: ELET 4720
Semester: FALL 2010

The Engineering Technology Department, in cooperation with the Office of Disability Accommodation, complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. Please present your written accommodation request to the instructor prior to the fourth day.

SAFETY CATEGORY: 1
DATE PREPARED: August 11, 2010  
PREPARED BY: Dr. Vijay Vaidyanathan

COURSE NUMBER, TITLE, CREDIT HOURS:
ELET 4720, Control Systems, 4 (3;3) Hours

DESCRIPTION:
Classical control theory; block diagrams, applications of Laplace transforms, stability criteria and feedback. Use of computer software to evaluate complex systems.

PREREQUISITES:
ELET 3700 and ELET 3740

REQUIRED TEXTBOOKS:

SUPPLEMENTAL TEXTS AND MATERIALS:
Books on Control Systems from the Engineering Library

COURSE OBJECTIVES: (TAC of ABET Criteria and Program Educational Objectives supported.

1. Understand open and closed loop control systems. (a,b,f)
2. Understand the transfer function of transient and steady state circuits. (b,c)
3. Understand Laplace transforms in circuits and systems solutions. (b,c,f)
4. Comprehend differential equations in the time-domain to the frequency-domain. (b,c,d,f)
5. Comprehend transfer function equations in the frequency-domain to differential equations in the time-domain. (a,b,c)
6. Understand transient and steady state circuits. (a,b,c,d,f)
7. Understand project reporting with suitable references. (e,f,g,h,k)
8. Participate effectively in groups with emphasis on listening, critical thinking and responding. (e,f,g,h,k5)
9. Comprehend B2spice, LabView, and MatLab SimuLink, or SystemView software to solve homework problems. (a,b,c,d,f)
STUDENT LEARNING OUTCOMES: (Course Objectives Supported)

a) Analyze control systems under steady-state sinusoidal conditions. (1, 2)
b) Determine the steady-state transfer function and show how it relates to the Laplace transform function. (2, 3)
c) Determine feedback and stability requirements of control systems. (2, 3)
d) Determine the inverse transform of a circuit and find the time domain equation of the current or voltage. (5).
e) Determine the transform of a circuit from the time domain equation of the current or voltage. (4).
f) Administer a Laplace transformation on an electrical circuit with or without initial conditions. (3)
g) Analyze functions of electronic circuits and feedback systems using Laplace Transforms. (3)
h) Write the transfer function of a given electrical circuit or system. (3)
i) Demonstrate the operation of laboratory instrumentation. (6)
j) Write a well researched and grammatically correct technical report on the experiment being orally presented and assigned laboratory experiments. (7)
k) Prepare and present a PowerPoint presentation incorporating the objectives, circuitry and expected results of the assigned laboratory experiment. (8)
l) Solve electronic circuits and control system transfer function problems with B2spice, MatLab, Simulink, LabView, and SystemView software to analyze electronic circuits and control system transfer functions. (9)

INSTRUCTIONAL OBJECTIVES

1. Conditions:
   a) Students can use pens, pencils, paper, calculator and textbooks during lectures.
   b) Students are allowed to download instructional material from the instructor’s website.
   c) Students are permitted to use electronic equipment, software, computer aided techniques, and parts kits in the laboratory.

2. Criteria:
   a) Students are required to attend lecture and laboratory classes.
   b) Homework and laboratory reports will be turned in on the due date.
   c) Students must pass the laboratory in order to pass the course.
   d) Makeup examinations will not be given.
   e) Students must demonstrate and present a successful, working final project.

3. Outcome Competencies:
   a) Homework and random quizzes will be used to assess understanding of materials covered in lecture.
   b) Examinations will be used to assess understanding of materials covered during the
semester in both lecture and laboratory.
c) Laboratory reports will be used to assess hands-on application of theory and use of test equipment, software and computer aided techniques.
d) Class Presentations and final project will be used to assess their understanding of control systems.

LEARNING STRATEGIES:

1. Lectures
2. Demonstrations

COURSE OUTLINE:

1. Introduction
   A. History and terminology
   B. Control Systems Engineer
2. Modeling in the frequency domain
   A. Laplace Transforms
   B. Transfer functions - electrical, electro-mechanical
3. Modeling in the time domain
   A. State Space representation
   B. Conversions from state space to transfer functions and reverse
4. Time domain
   A. Poles, zeros and system response
   B. First, second order systems
   C. Laplace transform solutions, state space solutions
5. Reduction of multiple subsystems
   A. Block diagrams
   B. Signal flow graphs
6. Stability
   A. Routh-Hurwitz criterion
7. Steady State Errors
   A. Unity feedback systems
   B. Error constants and system types
8. Design using Root Locus
   A. Definition
   B. Properties and sketch
   C. Lag and lead compensation

LABORATORY OUTLINE:

Selected Laboratory Topics:

1. Series RLC circuit
2. Second Order Active Low Pass Filter
3. Temperature Sensing System using LABVIEW
4. State Space Model
5. Introduction to SIMULINK
6. Second Order Damping Characteristics
7. DC Motor Transfer Function
8. System Stability & Routh-Herwitz Criterion
9. Control System Toolbox
10. Steady State Error

**COMPUTER USAGE:**

1. Control system techniques simulated on a PC environment using MATLAB, LabVIEW.
2. WEB links to Control Systems resources.

**ORAL COMMUNICATION USAGE:**

1. In class presentations, based on literature survey.
2. Group presentation of final project.
PRESENTATION GRADING GUIDE:

PRESENTER NAME ____________________ COURSE NAME __________________

SEMESTER _______ PROJECT TITLE ______________________________________

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<th>EVALUATION TOPIC</th>
<th>POSSIBLE POINTS</th>
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<td>1. Subject Introduction</td>
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<td>2. Organization of Topics</td>
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<td>3. Clear Descriptions</td>
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<td>4. Emphasized Pertinent Information</td>
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<td>5. Quality and Effective Use of Visual Aids</td>
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<td>6. Effective Conclusion</td>
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<td>7. Composure and Speaking</td>
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<td>8. Effective Demonstration with a working model</td>
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<td>9. Project Technical Content</td>
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<td>10. Subjective Evaluation</td>
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Composite Score

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WRITTEN COMMUNICATION USAGE:

1. Formal written reports are required for laboratory experiments
2. Students are required to submit a written report, in IEEE format of their final project.
WRITTEN GRADING GUIDE:

NAME ____________________________ COURSE NAME _____________________

REPORT DATE _______ DUE DATE _______ LABORATORY NUMBER _____

LABORATORY TITLE ___________________________________________________

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<th>EVALUATION TOPIC</th>
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<td>2. Diagrams</td>
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<td>4. Original Data Sheets</td>
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<td>5. Analysis of Results</td>
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<td>6. Conclusions</td>
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<td>7. Supportive Data</td>
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<td>8. Comments</td>
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<td>9. Professionalism signature</td>
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Composite Score                __________

Professionalism Signature (TA verifies the student preformed the experiment, that the position computer is logged of and position is clean.):

_____________________________________  Date Completed:____________________

EVALUATOR COMMENTS ____________________________________________
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LIBRARY USAGE:

Use of library facilities and references is encouraged. Lab reports, presentations and project reports need to include references from the library.

GRADING ELEMENTS AND WEIGHTS:

Two, One hour Exams 200 points  
Comprehensive Final  200 points  
Project 250 points  
Homeworks/Quizzes/Presentations  100 points  
Laboratory Reports/Exam  250 points

A passing grade in the laboratory is required to pass the course. A student needs to complete at least 60% of laboratory work to pass the laboratory work required for the class.

Grading Scale :   
A = 90-100  
B = 80-89  
C = 70-79  
D = 60-69  
F = 59 and below

GRADING POLICIES:

1. Tardiness is not allowed  
2. Attendance in mandatory, assignments can only be turned in during class.  
3. No work will be accepted after the last day of classes  
4. Assignments due one week after the date of assignment  
5. Assignments due at the start of the class period  
6. No late work will be accepted  
7. No work will be accepted if placed in my mailbox  
8. It is the student’s responsibility to remember the due date  
9. Assignments must be legible  
10. 8.5 x 11 inch paper is required and with perforated edges.  
11. All reports, & outside assignments must be processed with a computer  
12. Do not fold assignments  
13. Use only staples to attach multiple pages

CLASS POLICIES:

1. All rules relating to academic dishonesty will be enforced in accordance with University policies. Cheating on quizzes, examinations and laboratory assignments, and plagiarism on various papers and reports are types of disciplinary misconduct for
which penalties are assessed under the UNT Code of Student Conduct and Discipline. Major responsibility for implementing the University's policy on scholastic dishonesty rests with the faculty. Be advised that the instructor of this course supports and fully implements this policy. The following actions will be taken when evidence of such misconduct is observed. The student will be presented with the evidence of misconduct and given an opportunity to explain same. Based on the outcome of this private conference, the matter will be either dropped or the student will be given a grade of "F" in the course and be referred to the Dean of Students for further counseling and/or disciplinary action.

2. State common law and federal copyright laws protect my lectures. They are my own original expression and I record them at the same time that I deliver them in order to secure protection. Whereas you are authorized to take notes in class thereby creating a derivative work from my lecture, the authorization extends only to making one set of notes for your own personal use and no other use. You are not authorized to record my lectures, to provide your notes to anyone else or to make any commercial use of them without expressed prior permission from me.

3. During the course, handouts will be provided to enhance the presentation of certain concepts. These materials are provided strictly for instructional purposes and may other wise be restricted. There is no authorization for further reproduction of distribution of handout materials beyond that intended to teach the course.

4. This syllabus is subject to change at any time during the semester with changes to be announced in class.

5. Students should schedule at least one hour per lecture hour for study outside class. Students should schedule at least one hour per laboratory hour for outside work to prepare for the laboratory, use of open laboratory hours, and to complete the required laboratory documentation.

6. Grades are based, in part, on the student's ability to communicate. Well written English is expected in all course work and is a factor in laboratory report grades. The student’s ability to orally communicate the results of laboratory exercises and class assignments is also monitored.

7. Each student should retain graded lecture notes, pop quizzes, homework, tests, software-generated files, and laboratory reports to document errors in recorded grades.

8. Requests for review of graded work must be submitted during the lecture in which such work is returned to the students. The request should be accompanied by a written justification of the request including any supporting data.

9. The UNT Catalog procedures on cheating and plagiarism will be vigorously enforced. It is the duty of all students to protect their work so it is not available to others for
submission as their efforts. This is especially true of files that are generated on the computer. Students who knowingly allow others to use their work are partners in this unethical behavior.

10. There is no limit to the use of calculators for lecture, labs, pop quizzes, formal tests, or final examination.

11. Challenges to the course grade must be presented within 60 days of receipt of grade notices mailed by the university. This will insure that instructor’s records are still available to allow a review of the assigned grade. You should first discuss your complaint with the instructor. If you wish to carry it further, contact the Program Coordinator by calling (940) 565-2022. To further pursue your complaint, contact the Department Chair at (940) 565-2022, but ONLY after first discussing your concern with the previous two individuals.

12. If appropriate, Material Safety Data Sheets (MSDS) are maintained on file in the department for your review. Access to these documents may be provided by the:
   • instructor of this course,
   • Program Coordinator, or
   • Department Secretary.
   Seek initial access through the instructor or Coordinator rather than the secretary.

13. An I (incomplete) grade is given only for extenuating circumstances and in accordance with University and Departmental Policies.