University of North Texas  
College of Engineering  
Department of Engineering Technology (ETEC)  

ELET 4720 Control Systems

Catalog 13-14  ELET 4720. Control Systems. 4(3;3) hours. 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.

Lab Use  This course provides opportunities for students to take advantage of various software and hardware packages such as Matlab/Simulink, and NI/Quanser, supported by the department in the classroom or in lab experiments, in simulation studies, homework assignments, or in projects.

Text  Control Systems Engineering, Wiley, 3rd Edition (or newer); Author: Norman S. Nise

Instructor  Enrique Barbieri, Ph.D  
Professor and Chair, Engineering Technology  
Office F115  Office Hours: TBD

COURSE OBJECTIVES: ETAC/ABET Student Outcomes 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 systems. (b, c)
3. Understand how to use Laplace transforms in systems solutions. (b, c, f)
4. Comprehend differential equations in the time-domain and frequency-domain. (b, c, d, f)
5. Understand project reporting with suitable references. (e,f,g,h,k)
6. Participate effectively in groups in class or lab assignments with emphasis on communication skills and critical thinking. (e, f, g, h, k)
7. Use software packages to solve homework and/or lab problems. (a, b, c, d, f)

STUDENT LEARNING OUTCOMES: (Course Objectives Supported)

a) Analyze control systems under steady-state sinusoidal conditions. (1, 2)
b) Use Laplace Transforms to determine steady-state transfer functions. (2, 3)
c) Determine stability requirements of control systems. (2, 3, 4)
d) Determine inverse transforms in the time domain. (4, 5).
e) Demonstrate the operation of laboratory instrumentation. (6, 7)
f) Design and/or analyze given SISO feedback control systems using software. (7)
g) Write/present a well-researched and grammatically correct technical report. (6)

TOPICS COVERED

UNIT I  System modeling
UNIT II  Time response
UNIT III  Stability Analysis
UNIT IV  Steady-State Error Analysis
UNIT V  Root-Locus Techniques
UNIT VI  Design via Root Locus techniques
UNIT VII  Introduction to frequency-domain, digital, modern, and optimal control
CLASS POLICIES

1. The syllabus is subject to change during the semester with changes to be announced in class.
2. The UNT Catalog procedures on academic dishonesty 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. Students who knowingly allow others to use their work are partners in this unethical behavior.
3. Students in need of academic accommodations for disability can refer to the UNT Policy manual for initiating the required arrangements based on ADA terms.
4. The Student Evaluation of Teaching Effectiveness (SETE) is a requirement for all organized classes at UNT. This short survey will be made available to you at the end of the semester, providing you a chance to comment on how this class is taught. I am very interested in the feedback I receive from students, as I work to continually improve my teaching. I consider the SETE to be an important part of your participation in this class.
5. The use of communication, computing, or other electronic devices including laptops may be disallowed during class and/or exams at the discretion of the instructor.
6. No late work makeups, or extra credit. An exception to this policy requires a verifiable and sound excuse.

The Flipped Classroom Approach to Teaching & Learning
Various sets of lecture notes will be accompanied by questions and activities (Q&A) to encourage you to read ahead of the scheduled class time, do some research on a topic, further develop critical thinking skills, and essentially come better prepared to class. A subset of the lecture Q&A will be collected and graded to become part of the Homework grade. Class time will be better utilized to answer questions, solve additional problems, and exercise design techniques, rather than to cover the material. Goal: to facilitate your own construction of knowledge of the material.

On Work and Academics
A typical 3-credit class, meeting 3 hours per week, may require on average 5-7 additional hours of work per week that includes reading/catching up from the previous class and revising notes; preparation for the next class meeting, that is, reading ahead and formulating questions; solving additional practice problems; preparing for lab work (for example, pre-lab designs) and writing lab reports (applicable to courses with a lab component); and taking care of homework assignments. The total is 8-10 hours per week per course. Hence, a student taking a full-time load of say 12 credits (four 3-credit classes) requires on average 32-40 hours of academic work per week; this is why it is called a full-time load. Trying to also fit a full-time or even a part-time job always takes a toll. My advice is that a full-time academic load needs to be carefully balanced with all other non-academic activities, and accept the fact that if you work, then you must be a part-time student.

Grading & Instructor’s Expectations:
Students are expected to attend every class. The student’s abilities will be demonstrated via homework, projects, quizzes, exams, and lab projects. A final exam and at least one semester exam will be scheduled. Successful students attempt to solve many more problems than those assigned for credit to develop the practice and the necessary skills. Homework is due at the start of class (unless otherwise specified) at which time solutions may be distributed and discussed.

You are encouraged to work in groups and learn from each other. Individual work must be turned in for grading. You are responsible for understanding the techniques; avoid simply copying the group’s work as this practice typically results in disaster during the exams. Typically, students earn a very good Homework grade; however, quizzes and exams will give you the opportunity to demonstrate your individual understanding of the course material. Assuming that: problems are clearly stated and its solution presented in a professional manner (no
scratch work should be turned in) on 8½ paper, single-sided, your name, course and assignment number written at the top of the first page, THEN:

- All problems correct: 10 pts
- Few minor algebra mistakes leading to incorrect answers: 7 – 9 pts
- Several algebra mistakes or conceptual errors leading to incorrect answers: 4 – 6 pts
- Missing or wrong assignment problems: 1 – 4 pts
- Missing assignment or not complying with format: 0 pts

Final Grading:
To earn an “A” (above 90%) the student does outstanding work demonstrating excellence in his/her understanding of the course material as shown by performance. To earn a “B”, (above 80%) the student demonstrates good or above average performance.

Cumulative Points & Weights:
The table below lists all possible items that earn points toward the final grade and the equivalent % weight. The actual total number of points may be less than the maximum depending on the number of items assigned:

<table>
<thead>
<tr>
<th>Item</th>
<th>Points (max)</th>
<th>%</th>
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<tbody>
<tr>
<td>Homework (including Lecture Q&amp;A)</td>
<td>500</td>
<td>25</td>
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<tr>
<td>Tests / Quizzes</td>
<td>500</td>
<td>25</td>
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<tr>
<td>Labs / Project</td>
<td>500</td>
<td>25</td>
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<tr>
<td>Final test</td>
<td>500</td>
<td>25</td>
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<td>Total (max)</td>
<td>2000</td>
<td>100</td>
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<tr>
<td>Class Participation/Progress/Improvement</td>
<td>200</td>
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Calendar
August 28, 2013  First Class Day (Wednesday)
September 2, 2013  Labor Day (no classes; university closed)
November 28 - December 1, 2013  Thanksgiving Break (no classes: university closed)
November 30 - December 6, 2013  Pre-finals Week
December 5, 2013  Last Class Day (Thursday)
December 6, 2013  Reading Day (no classes)
December 7-13, 2013  Finals
December 13, 2013  Doctoral and Master's Commencement
December 14, 2013  Undergraduate Commencement

Final Exam Schedule
Final Exam Schedule  [http://essc.unt.edu/registrar/schedule/fall/final.html#chart1](http://essc.unt.edu/registrar/schedule/fall/final.html#chart1)
Final Exam on Tuesday December 10, 8:00AM-10:00AM
Tentative Lab Schedule
The order of the labs and contents may change

<table>
<thead>
<tr>
<th>Date</th>
<th>Lab Description</th>
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<tbody>
<tr>
<td>9/9</td>
<td>Lab 1: Introduction to Matlab (Accessible in the Engineering General Access Lab Room B129)</td>
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<tr>
<td>9/16</td>
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<tr>
<td>9/23</td>
<td>Lab 2: Introduction to Simulink</td>
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<td>9/30</td>
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<td>10/7</td>
<td>Lab 3: DC Motor Control – I</td>
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<td>10/21</td>
<td>Lab 4: DC Motor Control - II</td>
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<td>11/4</td>
<td>Lab 5: DC Motor Control - III</td>
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<td>11/18</td>
<td>Lab 6: Use of the SISO Tool in Matlab/Simulink</td>
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<tr>
<td>12/2</td>
<td>Lab 7: Advanced Quanser Setups - Demo</td>
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