CONTROL SYSTEMS I

Course Description
This course provides an introduction to the analysis of control systems. The main focus will be on techniques in classical control theory. System dynamics and modeling techniques in both the frequency domain and the time domain will be covered. Students will learn how to transform linear dynamical systems between state-space and frequency domains, and evaluate conditions for stability in each domain. Students will analyze and characterize both the transient and steady-state response, and examine root locus, Bode, and Nyquist plots. Concepts of robust control, including tradeoffs between sensitivity and performance, will be emphasized throughout. Applications will range across electrical, mechanical, chemical, biomedical, and biological systems. Laboratory activities include modeling, analysis and simulation of physical processes.

Learning Objectives
At successful completion of this course, the student will be able to:

1. Obtain mathematical models of electrical and mechanical systems from their idealized elements.
2. Derive the transfer function of a control system.
3. Apply their mathematical knowledge to determine the response of a linear system to various types of inputs.
4. Develop familiarity and confidence with analyzing transient and steady state responses of a linear system.
5. Apply their mathematical knowledge to understand the concept of stability.
6. Develop familiarity and confidence with controller design based on Routh-Hurwitz, Root locus and P, PI, PID modes of control.
7. Develop proficiency in systems simulation using MATLAB and SIMULINK.

Major Course Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Homework (10%)</td>
<td>To review and understand concepts or lessons in each chapter.</td>
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<tr>
<td>Test 1 (13.33%)</td>
<td>First test to examine the level of understanding for the first part of the learning objectives.</td>
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<tr>
<td>Test 2 (13.33%)</td>
<td>Second test to examine the level of understanding for the second part of the learning objectives.</td>
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<tr>
<td>Test 3 (13.33%)</td>
<td>Third test to examine the level of understanding for the third part of the learning objectives.</td>
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<tr>
<td>Laboratory (20%)</td>
<td>Laboratory reports for hands-on lab during the semester.</td>
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<tr>
<td>Final (30%)</td>
<td>Comprehensive measure of entire scope of learning objectives.</td>
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Total (100%)
Required or Recommended Readings


Recommended or Supplemental Reading:


State Adopted Proficiencies/TExES competencies (COE)

Course Policies

Attendance
I will not take attendance after the beginning of the semester. I expect all students to attend all classes and arrive on time. Late homework will only be accepted for cause; death in family, car accident, hospitalized, doctor appointments, etc.

Late work and Make-up Exams
Late work is not going to be accepted. Make-up Exams are only arranged with 1 week prior notice. No make-up exam will be arranged after each exam.

Student collaboration
I strongly encourage collaboration on homework. It will help many of you to understand the ideas better if you explain them to each other. Collaboration to understand problems and concepts is how best to succeed in the “working world”.

Homework and Exam should be submitted in an organized and neatly presented form. Circle or box the answers to each problem. Appropriate units must be included on all answers. All calculations need to be on an engineers pad. At the top of each page of homework write your name, the course number, the assignment number, and date. Pages are to be numbered and stapled.

Extra Credit:
Extra Credit questions/problems will be in some of the tests and homework.

Cell phone/Electronic Device Usage:
Neither cell phone nor electronic devices are allowed in the class as well as in the laboratory. Students are required to turn off cell phone and Electronic Devices before the class starts.

Academic Integrity/Plagiarism.

University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or
examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in class failure.

**Dropping a Class**

I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. April 11, 2014 is the last day to drop a class with an automatic grade of “W” this term.

**Preferred methods of scholarly citations**

**Classroom/professional behavior**

Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

**Statement of Civility (can be in place of classroom/professional behavior)**

Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of gender, ethnic/racial origin, religious background, age, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

http://falcon.tamucc.edu/~students/JAffairs/ja_hndbk_academic_info.htm

**Grade Appeals**

A student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may
appeal the final grade given in the course. The burden of proof is on the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details on the process, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, consult Texas A&M University-Corpus Christi University Procedure 13.02.99.C2.01 Student Grade Appeal Procedures (http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage (http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school or the College of Science and Engineering Dean’s Office.

Disabilities Accommodations*

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

Statement of Academic Continuity

In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.
## Syllabus

### Tentative Weekly Schedule

| Week 1: | January 22, 2023 | 1. | Introduction |
| Week 2-3: | January 27, 2023 | 2. | Modeling in the frequency domain |
| Week 4: | February 10, 2023 | 3. | Modeling in the time domain |
| Week 5-6: | February 17, 2023 | 4. | Time response |
| Week 7-8: | March 03, 2023 | 5. | Reduction of multiple subsystems |
| Week 9-10: | March 17, 2023 | 6. | Stability |
| Week 11-12: | March 31, 2023 | 7. | Steady-State errors |
| Week 13: | April 14, 2023 | 8. | Root locus techniques |
| Week 14: | April 21, 2023 | 9. | Design via root locus |
| Week 15-16: | April 28, 2023 | 10. | Frequency response techniques |
| Week 17: | May 5, 2023 | 11. | Design via frequency response |