Control Systems I – ENTC4446
Department of Engineering
Spring 2019

A. COURSE INFORMATION

Course number/section: ENTC 4446/001
Class meeting time: Tuesday and Thursday: 11:00 am - 12:15pm
Class location: EL-111
Lab meeting time: Tuesday and Thursday: 3:30 pm - 4:45pm
Class location: EL-110
Course Website: Blackboard

B. INSTRUCTOR INFORMATION

Instructor: Jose Baca
Office location: EN 222B
Office hours: Tuesday/Thursday: 5pm-6pm; Wednesday: 11am-1pm and 3:30pm-5:30pm
Telephone: (361) 825-2144
e-mail: jose.baca@tamucc.edu
Appointments: Direct contact or e-mail

C. COURSE DESCRIPTION

Catalog Course Description
Introduction to Control Systems

Extended 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.

D. PREREQUISITES AND COREQUISITES

Prerequisites
- Requires Registration in Lec/Lab/Rec; 2. Eligible MCET Students only.; 3. Otherwise requires approval of instructor.; 4. Prerequisite course required-ENTC2414

Corequisites
None
E. **REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES**

**Required Textbook(s)**

**Optional Textbook(s) or Other References**
None

**Supplies**
None

F. **STUDENT LEARNING OUTCOMES AND ASSESSMENT**

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should 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.

G. **INSTRUCTIONAL METHODS AND ACTIVITIES**

- Programming simulation using MATLAB and SIMULINK

H. **MAJOR COURSE REQUIREMENTS AND GRADING**

- Exams (40%) – There will be two in-class exams worth 10% of the final grade each, as well as a comprehensive final exam worth 20% of the final grade. Please note the dates of the exams on the course schedule below and plan accordingly. Exams may only be made up with an approved University excuse and will be different from the in-class version of the exam. If you have a conflict with an exam date, please let me know as soon as you know about the conflict.

- Assignments/Homework (20%) - As part of this class, you will have many homework assignments. These assignments are all *individual efforts* unless otherwise specified.
- Quizzes, Participation, and Attendance (10%) – You are expected to attend class, participate, and complete the assigned readings. In order to encourage and reward these behaviors, regular quizzes (on-line and in-class) will be given. You will also participate in-group and individual activities on a regular basis that will count towards your final grade. There are no make-ups for missed daily grades and it is your responsibility to consult the course website to determine what was covered during any days you miss and obtain notes from a classmate. Be sure to make use of office hours to meet with me to discuss any issues you have with the material or class assignments.

- Laboratory Projects (30%) - As part of this class, you will have to work on weekly laboratory project assignments. These projects are group effort.

- **Grade Scale:** A (90-100%) B (80-89%) C (70-79%) D (60-69%) F (<60%)

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<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Exams</td>
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<td>Homework</td>
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<td>Quizzes</td>
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<td>Laboratory Projects</td>
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### I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>CHAPTER(S)</th>
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<tr>
<td>Week 01</td>
<td>Introduction</td>
<td>CH01</td>
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<td>Week 02</td>
<td>Review of Laplace Transforms</td>
<td>CH02</td>
<td>HW01</td>
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<td>Week 02 - Week 03</td>
<td>Models of Physical Systems</td>
<td>CH03</td>
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<td>Week 03</td>
<td>Introduction to State Variables</td>
<td>CH03</td>
<td>HW02</td>
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<td>Week 04</td>
<td>Linearization and First Review</td>
<td>CH03</td>
<td>HW03 – HW04</td>
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<td>Week 04/05</td>
<td>Exam I</td>
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<td>Week 05</td>
<td>Time Response 1st Order Systems</td>
<td>CH04</td>
<td>HW05 – HW06</td>
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<td>Week 06</td>
<td>Time Response 2nd Order Systems</td>
<td>CH04</td>
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<tr>
<td>Week 06</td>
<td>Time response - Systems with additional poles and zeros</td>
<td>CH04</td>
<td>HW07</td>
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<td>Week 07</td>
<td>System Representation: Block Diagrams and Signal Flow Graphs</td>
<td>CH05</td>
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<td>Week 07</td>
<td>Stability: The Routh Hurwitz Criterion</td>
<td>CH06</td>
<td>HW08</td>
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<td>Week 08</td>
<td>Steady-State Errors</td>
<td>CH07</td>
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<td>Week 08</td>
<td>Proportional Control</td>
<td>CH07</td>
<td>HW09</td>
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<td>Week 09</td>
<td>Spring Break</td>
<td>CH07</td>
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<td>Week 10</td>
<td>Review</td>
<td>CH07</td>
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<td>Week 10/11</td>
<td>Exam II</td>
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Week 11  
Root Locus: Root Locus Rules, Intro. to Root Locus Design  
CH08  HW10-HW11

Week 12  
PI Control, PD Control  
CH09  HW12

Week 13  
PID Control  
CH09

Week 14  
Frequency Response Methods: Bode plots, polar plots, log magnitude-phase plots  
CH10  HW13

Week 15  
Nyquist Criterion: Stability, Phase Margin and Gain Margin, Proportional Control  
CH10  HW14

Week 15  
Frequency Response Design: Lag design, lead design  
CH11  HW15

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
- Students are expected to be in attendance, punctual, and prepared for class.

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.

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

Cell Phone Use
- Please refrain from the use of electronic devices during class, as it is distracting to not only you, but also to your instructor and peers. Silence your phones and put them away so you are not tempted to stray off task.

Laptop Use
- Laptops will be permitted for particular activities as deemed appropriate.

Food in Class
- No food or drinks are allowed during class.

Missed Exam
- If you have a conflict with an exam date, please let me know as soon as you know about the conflict.

Participation
- In-group and individual activities on a regular basis will count towards your final grade

Others
- All work submitted for grading must be the student's own work. Plagiarism will result in a score of 0 (zero) for the work or dismissal from the course and the Dean of Students office will be notified. No copying from another student's work of any type is allowed. It is the student's duty to allow no one to copy his or her work.

K. COLLEGE AND UNIVERSITY POLICIES

- Academic Integrity (University)
  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 a failing grade.

- **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**
  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 sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  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 your academic advisor, the Financial Aid Office, and me, before you decide to drop this course.** 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. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, 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 upon 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, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of
Science and Engineering Grade Appeals webpage at 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, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  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 (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.
  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. http://disabilityservices.tamucc.edu/

- **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.

L. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

- Assigned readings and quizzes, as discussed in class and usually found in Blackboard, should be completed before coming to the next class.
- You are expected to read the textbook.
- Quizzes will be frequent.

**GENERAL DISCLAIMER**
I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.