ENGR 4390 Selected Topics: Modern Control Systems  
School of Engineering and Computing Sciences  
Spring 2015

A. COURSE INFORMATION

Course number/section: ENGR 4390.004  
Class meeting time: TR 8:00-9:15 a.m.  
Class location: TBA  
Course Website: https://bb9.tamucc.edu/

B. INSTRUCTOR INFORMATION

Instructor: Hao Xu  
Office location: EN 313  
Office hours: M 2:00-4:00 p.m., T 2:00-4:00 p.m., W 2:00-4:00 p.m.  
Telephone: (361) 825-3731  
e-mail: hao.xu@tamucc.edu  
Appointments: Please send an email for making appointment if necessary

C. COURSE DESCRIPTION

Catalog Course Description  
Introduction to Modern Control Systems.

Extended Course Description  
This course provides an introduction to the analysis of modern control systems. The main focus will be on designs in modern control theory. System dynamics and modeling algorithm 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.

D. PREREQUISITES AND COREQUISITES

Prerequisites  
ENTC 3415 – Circuit Analysis II.

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

Required Textbook(s)

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:

- Obtain mathematical models of electrical and mechanical systems from their idealized elements.
- Derive the transfer function of a control system.
- Apply their mathematical knowledge to determine the response of a linear system to various types of inputs.
- Develop familiarity and confidence with analyzing transient and steady state responses of a linear system.
- Apply their mathematical knowledge to understand the concept of stability.
- Develop familiarity and confidence with controller design based on Routh-Hurwitz, Root locus and P, PI, PID modes of control.
- 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 (50%) – There will be three 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.

- Programming Assignments/Homework (30%) - 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.
- Final Project (10%) - As part of this class, you will have to work on a final project assignment. The final project is an individual effort.
- **Grade Scale**: A (90-100%) B (80-89%) C (70-79%) D (60-69%) F (<60%).

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams</td>
<td>50</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10</td>
</tr>
<tr>
<td>Homework</td>
<td>30</td>
</tr>
<tr>
<td>Final Project</td>
<td>10</td>
</tr>
</tbody>
</table>

**I. COURSE CONTENT/SCHEDULE**

The following is a rough outline and is subject to change. See the course website for the most up to date information.

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
<th>CHAPTER(S)</th>
<th>ASSIGNMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/20</td>
<td>Introduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01/25</td>
<td>Modeling in the frequency domain</td>
<td></td>
<td>Assignment 1</td>
</tr>
<tr>
<td>02/08</td>
<td>Modeling in the time domain</td>
<td></td>
<td>Assignment 2</td>
</tr>
<tr>
<td>02/15</td>
<td>Time Response</td>
<td></td>
<td>Assignment 3</td>
</tr>
<tr>
<td>02/29</td>
<td>Reduction of multiple subsystems</td>
<td></td>
<td>Assignment 4</td>
</tr>
<tr>
<td>03/14</td>
<td>Spring Break (No classes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/21</td>
<td>Stability</td>
<td></td>
<td>Assignments 5,6</td>
</tr>
<tr>
<td>Date</td>
<td>Topic</td>
<td>Assignment</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>04/04</td>
<td>Steady-state errors</td>
<td>Assignment 7</td>
<td></td>
</tr>
<tr>
<td>04/11</td>
<td>Root locus techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04/18</td>
<td>Design via root locus</td>
<td>Assignment 8</td>
<td></td>
</tr>
<tr>
<td>04/25</td>
<td>Frequency response techniques</td>
<td>Assignment 9</td>
<td></td>
</tr>
<tr>
<td>05/02</td>
<td>Design via frequency response</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**
Attendance is **required** since the student will be responsible for all materials that are covered in class. If you miss a class due to unavoidable circumstances, you should copy class notes from another student in the class. Attendance is mandatory for exams and the final exams. Repeated tardiness will not be tolerated.

**Late Work and Make-up Exams**
No makeup exams and late work are allowed without prior permission of the instructor (Very difficult to obtain)

**Cell Phone Use**
Turn off and switch the cell phone to silence mode.

**Laptop Use**
Turn off the personal laptop. During the lecture time, the laptop is not needed. For the lab time, the personal laptop is allowed only when the instructor gives the permission.

**Food in Class**
Eating or drinking is NOT permitted in the classes. Students with food or drink will be asked to discard them, or leave the room.

**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. Anyone found cheating and/or copying, in the exams or assignments, in the instructor's opinion, may receive an
automatic F for the course.

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)
  The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must submitted. No student is eligible to receive a W without completing the official drop process by this deadline. 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.

**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.