



EE 435 Control Systems

3 (3, 0) [Semester Credit Hour (Lecture, lab)]

COURSE SYLLABUS: Spring 2024

INSTRUCTOR INFORMATION

Instructor: Nizar Tayem, PhD

Assistant Professor, Electrical Engineering
Department of Engineering and Technology

Office Location: AG/ET 218

Office Hours: Mondays- 8:00am-10:00am, Tuesdays 8:30-9:30
& 10:45am-12:15pm, Thursdays- 11:00am-12:00pm

Office Phone: 903-886-5706

Office Fax: 903-886-5960 (Inform instructor when fax is sent)

University Email Address: Nizar.Tayem@tamuc.edu

Preferred Form of Communication: email

Communication Response Time: 24 hours (weekdays) to email

COURSE INFORMATION

Materials - Textbooks, Readings, Supplementary Readings

Course Format:

The class consists of lectures and simulation Laboratory exercises.

Class Meeting Schedule: Meets 1/10/2024 through 5/10/2024

Class Meeting Dates: Monday (9 AM– 11:00 AM)

Monday (12:00 PM– 2:00 PM)

Classroom: AG/ET 217

The syllabus/schedule are subject to change.

Textbook Required:

- Dorf, Richard C. and Robert H. Bishop: Modern Control Systems. 13th Ed. Pearson Education, 2016.
- Dorf, Richard C. and Robert H. Bishop : Modern Control Systems with LabVIEW™ (Free download available)

Optional References:

- N.S. Nise, Control Systems Engineering, 7th Edition, Wiley, 2015,
- Cochin, I., and W. Cadwallender, Analysis and Design of Dynamic Systems. 3th Ed. Addison Wesley, NY, 1997.
- Katsuhiko Ogata, Modern Control Engineering. 5th Ed. Prentice Hall, 2010

Software Required:

Microsoft Office - MS Word, Excel, Power-point
MATLAB
LABVIEW

Course Description:

This course teaches approaches to analyze and interpret dynamic engineering systems to implement proper feedback control methods that can achieve proper design performance. It covers various topics including transient response analysis and systems stability and damping. It also presents frequency and time domains techniques to analyze and design various dynamic control systems, such as root locus, frequency response analysis, and PID controllers. The material is complemented by Laboratory experiments that treat control systems for various applications using simulation software tools (e.g. MATLAB/Simulink, LabVIEW) and hardware equipment

Prerequisites: [EE 430](#) with a minimum grade of C.

Student Learning Outcomes:

After successfully completing the course, students will be able to:

1. Describe common features of control systems.
2. Analyze the transient response and steady state of linear systems.
3. Apply the root locus and frequency response methods to analyze and design feedback systems.
4. Describe the operation and design of PID-, lead-, lag- and lead-lag feedback controllers to meet time-domain specifications using root locus and frequency response methods.
5. Design control systems using state space techniques.
6. Examine the design and operation of control problems using hardware and software.

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7. Demonstrate effective oral and written communication skills through class and Lab discussions.
8. Use IT tools and numerical techniques to solve assignments and Lab exercises.

COURSE REQUIREMENTS:

Minimal Technical Skills Needed

Working knowledge and basic skills using Microsoft Word, Excel, and PowerPoint.

Instructional Methods:

The instructional methods in this course include; lectures, class discussion, course project, written assignments, problem solving, lab exercises, open ended problems, case study, and simulation assignments using software.

Instruction will be based on the course textbook and the lab manual.

Student Responsibilities or Tips for Success in the Course:

Attendance:

Attendance is a requirement for this course. The instructor will take attendance at each class. Class Attendance Requirement (one lateness = 1/2 absence)

# of Absences	0 – 3	4	5	6	7	>7
Point Deduction	0	- 5	- 10	- 20	- 30	F

Unless directed and/or approved by the instructor, only MS Office-compatible formats (.doc, .docx, .rtf, .xls, .xlsx, .ppt and .pptx) will be accepted for assignments and submissions. NO OTHER DOCUMENT OR FILE FORMATS WILL BE ACCEPTED.

Failure to comply with required document formats will result in late or rejected assignments (zero credit).

Other specific formats may be dictated based on assignment and will be coordinated with/by the instructor prior to submission to assignment drop boxes.

Microsoft Word, Excel, PowerPoint, or Project files will be placed in the assigned drop boxes in eCollege in the accepted formats only (identified above). **Note:** Many students do not fully utilize the power within this document processing software. This can assist the user when they know how to use more of the functions in these standard tools. The use of the spelling and

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grammar checkers, page and section breaks, and APA templates is highly encouraged PRIOR to submission of assignments.

APA Formatting is required for all reports assigned during this class. Non-adherence to APA formatting will result in points deduction on the assignment.

GRADING:

The final course grade is based on 100 possible points (as described below in Assessments) and will be calculated based on the following grading scale:

Grading Scale:

A = 90-100 points

B = 80-89 points

C = 70-79 points

D = 60-69 points

F = < 60 points

Assessments:

The following assessments will be performed throughout this course to assess individual progress toward learning outcomes. The final course grade will be calculated based on the following assessments:

Assessment task	Due Time	Weight
Homework	Three Homework	15 %
Quizzes	3, 6	10 %
Midterm Exam	8	15 %
Final Exam	16	30 %
Laboratory exercises /Simulation	Every three weeks	30 %

Homework Assignments: Homework Assignments are due at the beginning of class, delivered in the appropriate drop box. No late submissions will be accepted. Some homework assignments will include the submission of simulation files created in Simulink/MATLAB. Any file that is flagged as infected with malware or viruses will be receive a grade of zero. The instructor will use Norton Internet Security, and the student is advised to use something at least as good as NIS.

Exams and Quizzes

The two major examinations and two quizzes

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Lab Safety Training: Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities. Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., through the following August) and must be completed anew in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned.

Design Project: Students are required to complete a course design project and submit a comprehensive report at the end of the course. The project should demonstrate the student's ability to link the theoretical knowledge and practical skills acquired in the course to real-world applications. Student will work in a group up to three students. Students will submit their project proposal at week 8 to instructor for approval.

Lab Exercises:

This lab addresses the principles of control systems, their analysis and design. Students will acquire practical skills through performing several experiments in designing, implementing, and testing controllers for a variety of systems. This Lab is based on National Instruments hardware and LabVIEW Software, MATLAB, and SIMULINK

There will be 4 to 5 Lab Assignments distributed over the semester. Students will work in group of up to three students.

Pre-labs must be completed prior to coming to lab. Students will be turned away from the Lab if the Pre-lab is not complete.

Formal Lab Reports should follow the same approach used in the lab, which is a Hypothesis/Test sequence. In Prelab, you will be asked to design a circuit to perform a specific function. During the lab time you built the circuit and collected test data to show how the circuit performed. The report, then, should be constructed as follows:

1. **Cover page:** Your lab report cover page should include the following information:
 - Course name and title
 - Experiment number and title
 - Names of group members and their IDs
 - Instructor's name.
 - Date
2. **Objectives:** State clearly the objectives of the experiment
3. **Equipment required:** List all the equipment and components used in the experiments
4. **Introduction:** Provide the necessary background to the problem that you are trying to solve in the lab and the approach to solve it.
5. **Procedure:** Each part of the lab experiment should explain the following:
 - Basic measurements and calculation
 - Explanation of the derived solution
 - Schematics developed that demonstrate the solution

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6. Results and Analysis: Each part of lab experiment should have the following:

- Include tests used to prove the solution worked.
- Include drawing of the solution you built in lab.
- State the observations made while performing the lab and an explanation of your results

7. Conclusions: In this section of the lab:

- Describe what you did and learned from the lab.
- Explain at what degree the objectives of the lab were achieved.
- Describe possible real time applications from the work done in the lab

A Formal Lab Report should enable someone else to duplicate your work and obtain the same results without reference to any other documents. This does not mean that you should append data sheets to your report but that the schematics and parts layout should be clear and accurate.

Submit the files containing the circuit simulation, a schematic, and data which explain the lab results you obtained. Graphics must be created using a graphics program. Graphics in your lab reports may not be hand-drawn.

Lab Reports are due as hardcopy and by submission to the drop-box before lab time one week after the lab was performed. 10% per day will be deducted from the final lab grade for each 24 hours or portion thereof that a lab is late. Hardcopy of Lab Reports are to be submitted to the instructor.

Student Outcomes (ABET):

The program must have documented student outcomes that support the program educational objectives. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Student outcomes are outcomes (1) through (7), plus any additional outcomes that may be articulated by the program.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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This course will assess the achievement of the following student outcomes:

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

COURSE OUTLINE / CALENDAR

The instructor reserves the right to adjust the schedule in order to serve the needs of the class and any changes will be communicated in a timely manner.

Course schedule:

1. Topics Covered (Tentative Schedule)

Week	TOPICS	Assignment/Exams
1	Chapter 1 Introduction to Control Systems	
2-3	Chapter 2 Mathematical Models of Systems	Quiz 1/HW1
4-5	Chapter 4 Feedback Control System Characteristics	HW2
6-7	Chapter 5 The Performance of Feedback Control Systems	Quiz 2
8-10	Chapter 6 The Stability of Linear Feedback Systems	Midterm Exam
11-12	Chapter 7 The Root Locus Method	HW3
13-14	PID Control Design	Handout
15	Introduction to Frequency Domain Controller Design	Handout
16		Final Exam

Laboratory schedule:

Lab #	Experiment	Week
1	Simulation Using LabVIEW	2
2	DC Motor Modeling	3-5
3	DC Motor Speed Control	6-8

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5	DC Model Position Control	9-11
6	Inverted Pendulum Control	12-14
5	Stability Analysis	15

TECHNOLOGY REQUIREMENTS

- To fully participate in online courses, you will need to use a current Flash enabled internet browser. For PC and Mac users the suggested browser is Mozilla Firefox.
- You will need regular access to a computer with a broadband Internet connection. The minimum computer requirements are:
 - 512 MB of RAM, 1 GB or more preferred
 - Broadband connection required courses are heavily video intensive
 - Video display capable of high-color 16-bit display 1024 x 768 or higher resolution
- You must have a:
 - Sound card, which is usually integrated into your desktop or laptop computer
 - Speakers or headphones.
 - *For courses utilizing video-conferencing tools and/or an online proctoring solution, a webcam and microphone are required.
- Both versions of Java (32 bit and 64 bit) must be installed and up to date on your machine. At a minimum Java 7, update 51, is required to support the learning management system. The most current version of Java can be downloaded at: [JAVA web site http://www.java.com/en/download/manual.jsp](http://www.java.com/en/download/manual.jsp)
- Current anti-virus software must be installed and kept up to date.
- Run a browser check through the Pearson LearningStudio Technical Requirements website. [Browser Check http://help.ecollege.com/LS_Tech_Reg_WebHelp/en-us/#LS_Technical_Requirements.htm#BrowserSet](http://help.ecollege.com/LS_Tech_Reg_WebHelp/en-us/#LS_Technical_Requirements.htm#BrowserSet)

Running the browser check will ensure your internet browser is supported.

Pop-ups are allowed.

JavaScript is enabled.

Cookies are enabled.

- You will need some additional free software (plug-ins) for enhanced web browsing. Ensure that you download the free versions of the following software:
 - [Adobe Reader https://get.adobe.com/reader/](https://get.adobe.com/reader/)
 - [Adobe Flash Player \(version 17 or later\) https://get.adobe.com/flashplayer/](https://get.adobe.com/flashplayer/)
 - [Adobe Shockwave Player https://get.adobe.com/shockwave/](https://get.adobe.com/shockwave/)

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- [Apple Quick Time](http://www.apple.com/quicktime/download/) <http://www.apple.com/quicktime/download/>
- At a minimum, you must have Microsoft Office 2013, 2010, 2007 or Open Office. Microsoft Office is the standard office productivity software utilized by faculty, students, and staff. Microsoft Word is the standard word processing software, Microsoft Excel is the standard spreadsheet software, and Microsoft PowerPoint is the standard presentation software. Copying and pasting, along with attaching/uploading documents for assignment submission, will also be required. If you do not have Microsoft Office, you can check with the bookstore to see if they have any student copies.
- For additional information about system requirements, please see: [System Requirements for LearningStudio](https://secure.ecollege.com/tamuc/index.learn?action=technical) <https://secure.ecollege.com/tamuc/index.learn?action=technical>

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ACCESS AND NAVIGATION

Pearson LearningStudio (eCollege) Access and Log in Information

This course will be facilitated using Pearson LearningStudio, the learning management system used by Texas A&M University-Commerce. To get started with the course, go to [myLeo](http://www.tamuc.edu/myleo.aspx) and from the top menu ribbon select eCollege. Then on the upper left side of the screen click on the My Courses tab. <http://www.tamuc.edu/myleo.aspx>

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu.

Note: It is strongly recommended you perform a “Browser Test” prior to the start of your course. To launch a browser test login to Pearson LearningStudio, click on the My Courses tab, and then select the Browser Test link under Support Services.

Pearson LearningStudio Student Technical Support

Texas A&M University-Commerce provides students technical support for the use of Pearson LearningStudio.

Technical assistance is available 24/7 (24 hours, 7 days a week).

If you experience LearningStudio (eCollege) technical problems, contact the LearningStudio helpdesk at 1-866-656-5511 (toll free) or visit [Pearson 24/7 Customer Support Site](http://247support.custhelp.com/) <http://247support.custhelp.com/>

The student help desk may be reached in the following ways:

- **Chat Support:** Click on '*Live Support*' on the tool bar within your course to chat with a Pearson LearningStudio Representative.
- **Phone:** 1-866-656-5511 (Toll Free) to speak with Pearson LearningStudio Technical Support Representative.

Accessing Help from within Your Course: Click on the '*Tech Support*' icon on the upper left side of the screen inside the course. Then you will be able to get assistance via online chat or by phone.

Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary

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use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

Policy for Reporting Problems with Pearson LearningStudio

Should students encounter Pearson LearningStudio based problems while submitting assignments/discussions/comments/exams, the following procedure must be followed:

1. Students must report the problem to the help desk. You may reach the helpdesk at 1-866-656-5511.
2. Students must file their problem with the helpdesk and obtain a helpdesk ticket number
3. Once a helpdesk ticket number is in your possession, students should email me to advise me of the problem and provide me with the helpdesk ticket number.
4. I will call the helpdesk to confirm your problem and follow up with you

PLEASE NOTE: Your personal computer and internet access problems are not legitimate excuses for filing a ticket with the Pearson LearningStudio Help Desk. Only Pearson LearningStudio based problems are legitimate reasons to contact the Help Desk.

You strongly are encouraged to check for your internet browser compatibility **BEFORE** the course begins and take the Pearson LearningStudio tutorial offered for students who may require some extra assistance in navigating the Pearson LearningStudio platform.

myLeo Support

Your myLeo email address is required to send and receive all student correspondence. Please email helpdesk@tamuc.edu or call us at 903-468-6000 with any questions about setting up your myLeo email account. You may also access information at [myLeo](https://leo.tamuc.edu).
<https://leo.tamuc.edu>

Learner Support

The [One Stop Shop](http://www.tamuc.edu/admissions/onestopshop/) was created to serve you by providing as many resources as possible in one location. <http://www.tamuc.edu/admissions/onestopshop/>

The [Academic Success Center](http://www.tamuc.edu/campusLife/campusServices/academicSuccessCenter/) provides academic resources to help you achieve academic success.
<http://www.tamuc.edu/campusLife/campusServices/academicSuccessCenter/>

FREE Mobile APPS

The Courses apps for phones have been adapted to support the tasks students can easily complete on a smaller device. Due to the smaller screen size course content is not presented.

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The Courses app is free of charge. The mobile Courses Apps are designed and adapted for different devices.

	App Title:	iPhone - Pearson LearningStudio Courses for iPhone Android - LearningStudio Courses - Phone
	Operating System:	iPhone - OS 6 and above Android - Jelly Bean, Kitkat, and Lollipop OS
	iPhone App URL:	https://itunes.apple.com/us/app/pearson-learningstudio-courses/id977280011?mt=8
	Android App URL:	https://play.google.com/store/apps/details?id=com.pearson.lsphone

Once downloaded, search for Texas A&M University-Commerce, and it should appear on the list. Then you will need to sign into the myLeo Mobile portal.

The Courses App for Android and iPhone contain the following feature set:

- View titles/code/Instructor of all Courses enrolled in online
- View and respond to all discussions in individual Courses
- View Instructor Announcements in individual Courses
- View Graded items, Grades and comments in individual Courses
- Grade to Date
- View Events (assignments) and Calendar in individual Courses
- View Activity Feed for all courses
- View course filters on activities
- View link to Privacy Policy
- Ability to Sign out
- Send Feedback

LearningStudio Notifications

Students can be alerted to course activities via text on their mobile phones or up to two email addresses.

Based on their preferences, students can automatically receive a push notification with every new: course announcement, threaded discussion post, grade, and/or assignment without having to login to the course. Enrolled students will automatically receive email notifications for announcements and can opt out of this feature. To receive text notifications, students must opt in.

To begin setting up notifications, go into your course in LearningStudio and click on the bell-shaped Notifications icon on the main menu ribbon.

By default, the student's university email address will appear. This cannot be changed in LearningStudio. Additional email addresses may be added by clicking the Add

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button. After all of the other selections are completed be sure to click the Save and Finish button.

COMMUNICATION AND SUPPORT

Interaction with Instructor Statement

The instructor's communication response time and feedback on assessments are stated clearly.

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures/Policies

Attendance/Lateness, Late Work, Missed Exams and Quizzes and Extra Credit

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the [Student Guidebook](#).

<http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx>

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: [Netiquette](#)

<http://www.albion.com/netiquette/corerules.html>

TAMUC Attendance

For more information about the attendance policy please visit the [Attendance](#) webpage and [Procedure 13.99.99.R0.01](#).

<http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx>

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf>

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Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

[Undergraduate Academic Dishonesty 13.99.99.R0.03](#)

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf>

[Graduate Student Academic Dishonesty 13.99.99.R0.10](#)

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf>

ADA Statement

Students with Disabilities

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 have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services

Texas A&M University-Commerce

Gee Library- Room 162

Phone (903) 886-5150 or (903) 886-5835

Fax (903) 468-8148

Email: studentdisabilityservices@tamuc.edu

Website: [Office of Student Disability Resources and Services](#)

<http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/>

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

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Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the [Carrying Concealed Handguns On Campus](#) document and/or consult your event organizer.

Web url:

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf>

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.