The University of Texas at Tyler
Department of Electrical Engineering

Course: EENG 4308.031 – Automatic Control (Required)

Syllabus

Catalog Description:

Introduction to automatic control systems; mathematical models of physical systems; block diagrams and signal flow graphs; transient and steady state responses; PID controllers; stability of linear feedback systems; root-locus and Routh's criteria; frequency response methods: polar, Nyquist and Bode plots; stability margins; state-variable formulation. **Prerequisites:** EENG 3305 (or EENG 3304 for non-EE) and MATH 3305 or permission of the instructor.

Prerequisites: EENG 3305 and MATH 3305

Credits: 3 (3 hours lecture, 0 hours laboratory per week)

Text(s): Richard Dorf and Robert Bishop, Modern Control Systems, 13th ed., Prentice-Hall, 2010.

Additional Material: Matlab®
Instructor's Lecture Notes

Course Coordinator: Dr Joseph Kamto

Topics Covered: (paragraph of topics separated by semicolons)

Introduction to automatic control systems; mathematical models of physical systems; block diagrams and signal flow graphs; transient and steady state responses; PID controllers; stability of linear feedback systems; root-locus and Routh's criteria; frequency response methods: polar, Nyquist and Bode plots; stability margins; introduction to state-space systems.

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Objectives[1]: By the end of this course students will be able to:

1. Develop mathematical models of engineering systems. [1,2]
2. Determine the transfer function of linear time-invariant control systems. [1,2]
3. Obtain the transient response of a second-order system. [1,2]
4. Determine the sensitivity, steady-state error, rise-time, time to-peak, settling-time, percentage peak overshoot, and transient response to step, impulse, and ramp input signals. [1,2]
5. Determine the absolute stability of a control system using the Routh-Hurwitz criterion. [1,2]
6. Determine the stability of a control system using the Root-Locus method. [1,2]
7. Apply flow graph representation with Mason Gain rule to determine transfer function of a control system. [1,2]

8. Determine the stability and Performance of a control system using the Nyquist criterion. [1,2]
9. Analyze the performance of PI and PID controllers for simple control systems. [1,2]
10. Setup the state-space equations for simple systems. [1,2]
11. Analyze transient performance of control systems using advanced simulation software. [4]
12. Analyze control system stability using advanced simulation software. [4}

[1] *Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Program Student Outcomes (only items in dark print apply)[2]: This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. have the ability to apply mathematics, science, and engineering principles in the practice of electrical engineering; [3]
2. have the ability to use modern engineering tools and techniques in the practice of electrical engineering; [12,13]
3. have the ability to analyze electrical circuits, devices, and systems; [4,7,8,9]
4. have the ability to design electrical circuits, devices, and systems to meet application requirements; [5,6]
5. have the ability to design and conduct experiments, and analyze and draw conclusions from experimental results;
6. have the ability to identify, formulate, and solve problems in the practice of electrical engineering using appropriate theoretical and experimental methods; [1,2]
7. have effective written, visual, and oral communication skills; [4,5,6]
8. possess an educational background to understand the broader context in which engineering is practiced, including:
   a. knowledge of contemporary issues related to science and engineering;
   b. the impact of engineering on society;
   c. the role of ethics in the practice of engineering;
9. have the ability to contribute effectively to multi-disciplinary engineering teams; [1,4]
10. have a recognition of the need for and ability to pursue continued learning throughout their professional careers. [10,11]

[2] *Numbers in brackets refer to course objective(s) that address the Program Outcome.*

Contribution to Meeting Professional Component: (in semester hours)

Mathematics and Basic Sciences:	0.5	Hours
Engineering Sciences and Design:	2.5	Hours
General Education Component:		Hours

Prepared By:	Ron Pieper	Date:	02/07/2016
	Hassan El-Kishky		01/15/2019 (revised)

Background on grading and study habits	Typical ranges for grades in this class run as follows, 91-100% A, 80-90% B, 69% to 79% C. The class examples and HW problems provide a basis for gauging you comfort level with the material. The amount of time a student should study cannot always be easily quantified due to differences between students.
Academic Integrity	Students should be aware that absolute academic integrity is expected of every student in all undertakings at The University of Texas at Tyler. Failure to comply can result in strong university-imposed penalties.
Homework and Lab Project Policy	Homework and project reports will be due in class or lab one week after assignment. Project reports should be written as per the guidelines provided. A 25% penalty will be assessed per week for late project reports and homework. The progressive nature of the class means that perfect attendance is recommended if a good grade is desired.
Classroom Etiquette	Please remember to turn off cell phones before coming to class. Working on class assignments or surfing the web while class is going on is not acceptable. If these activities are important for you on a particular day, it would be better you did them outside the class environment. That being said attendance is important and will take periodically during the semester. If you know you have an emergency schedule conflict that comes up, please inform me (email OK). Although I do not plan to integrate attendance data in with student evaluation it can and will provide additional information if a student is experiencing problems keeping up
Student Responsibility	To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php *Adult behavior is expected. Disruptive behavior/activities that interfere with teaching and/or learning will not be tolerated and may result in an administrative withdrawal without refund.*

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Department of Electrical Engineering

ENGR 4308 – Automatic Control Systems
2019 Spring Semester
Course Outline

Grading Policy	Homework Exam 1/ Exam 2 Exam Midterm Final Examination Lab Exercises	20% 20% 20% 30% 10%	**Grade Assignment**	A B C D	90% 80% 70% 60%

Schedule

Tentative schedule	**Week-1-5**	1. Syllabus 2. Control System Design 3. Mathematical Models of Systems (a). Differential Equations of Physical Systems (b). The Laplace Transform
		(c). The Transfer Function of Linear Systems (d). Block Diagram Models (e). Signal-Flow Graph Models
	Week 5 (February 14)	Exam 1
	Week 6-8	4. Feedback Control System Characteristics (a). Error Signal Analysis (b). Sensitivity of Control Systems to Parameter Variations (c). Disturbance Signals in a Feedback Control Systems (d). Control of the Transient Response (e). Steady-State Error
	Week-8 (March 7)	Midterm Exam
	Week-9-12	5. The Performance of Feedback Control Systems 6. Stability of Linear Feedback Systems 7. Frequency Response Methods
	Week-12 (April 4)	Exam II
	Week-13-16	8. Stability in the Frequency Domain 9. The Design of Feedback Control Systems
	Week-16 (April 25)	Final Exam