

**The University of Texas at Tyler**  
**Department of Electrical Engineering**

**EENG 4308.031 – Automatic Control Systems (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; P, PI, PD, and PID controllers; stability of linear feedback systems; root-locus and Routh's criteria; frequency response methods; Nyquist and Bode plots; stability margins; state-variable formulation of dynamic systems.

**Prerequisites:** EENG 2101, EENG 3305 (or EENG 3304 for non-EE) and MATH 3305.

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

**Text(s):** Richard Dorf and Robert Bishop, Modern Control Systems, 13<sup>th</sup> ed., Prentice-Hall, 2016.

**Additional Material:** Matlab®  
Instructor's Lecture Notes

**Course Coordinator:** Ali Ghorshi, PhD

**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<sup>1</sup>:** 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 the 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. Utilize engineering literature such as technical manuals and product datasheets to select components to meet experimental or prototype requirements. [1,2]
12. Analyze transient performance of control systems using advanced simulation software. [4]
13. Analyze control system stability using advanced simulation software. [4]

<sup>1</sup>Numbers in brackets refer to method(s) used to evaluate the course objective.

Relationship to Student Outcomes (only items in dark print apply)<sup>2</sup>: This course supports the following Electrical Engineering Student Outcomes, which state that our students will possess:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics; [3, 4, 7, 8, 9]
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; [1, 2, 5, 6]
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; [16, 17]
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; [12, 13]
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. [10, 11]

<sup>2</sup>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	Hours
Engineering Sciences and Design:	3.0	Hours
General Education Component:	0	Hours

<u>Prepared By:</u>	Hassan El-Kishky	<u>Date:</u>	11/24/09
<u>Revised By:</u>	Ron Pieper Ali Ghorshi	<u>Date:</u>	01/07/2020 12/22/2021