The University of Texas at Tyler
Department of Electrical Engineering

EENG 4308-040 – 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, 13th 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[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 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]

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

Relationship to Student Outcomes (only items in dark print apply)[2]: 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]

[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	Hours
Engineering Sciences and Design:	3.0	Hours
General Education Component:	0	Hours

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