

Course	ME 33300 – Automatic Control Systems
Cross-listed Course	ECE 33300 – Automatic Control Systems
Type of Course	Required for the ME program
Catalog Description	Analysis and design of control systems, from modeling and computer solutions to stability and performance issues with an orientation toward electrical and mechanical systems. Classical control system concepts are emphasized but an introduction to modern techniques is also provided.
Credits	3
Contact Hours	3
Prerequisite Courses	ME 33100
Corequisite Courses	None
Prerequisites by Topics	Calculus, ordinary differential equations, Laplace transforms, elementary complex variables, elementary linear algebra, and elementary dynamics.
Textbook	<i>Modern Control Systems</i> , R. C. Dorf and R. H. Bishop, Prentice Hall, current edition.
Course Objectives	This is an introductory course in control systems. The aim is to provide both EE and ME students with the background needed to model and design automatic control systems for electrical, mechanical, and electromechanical systems using the classical concepts of root locus, Bode plots, and Nyquist diagrams, and to assess the stability and performance of such systems. An introduction to the state space techniques is also provided. Matlab and Simulink are used as the primary computer aided design tools for control systems.
Course Outcomes	Students who successfully complete this course will have demonstrated an ability to: <ol style="list-style-type: none">1. Obtain mathematical models of simple electrical, mechanical, and electromechanical systems. (1, 7)2. An ability to construct and reduce the block diagrams of interconnected systems. (1, 7)

3. Perform stability analysis of linear time-invariant systems. **(1, 7)**
4. Perform performance analysis of linear time-invariant systems. **(1, 7)**
5. Design controllers to meet specifications in the time and frequency domains. **(2)**
6. Use computer-aided tools for control systems analysis and design. **(7)**

Lecture Topics

1. Signals, systems, and response
2. Laplace transform and partial fraction expansion
3. Block diagrams and signal flow graphs
4. Stability and Routh-Hurwitz criterion
5. Modeling electrical and mechanical systems
6. Modeling electromechanical systems
7. Time-domain specifications, performance measures, simulations
8. State space modeling and response
9. Steady-state error and internal model principle
10. Sensitivity in feedback systems
11. Disturbance attenuation
12. Root locus analysis and design
13. Bode analysis and design
14. Nyquist analysis
15. Nichols chart analysis and design
16. Stability and Lyapunov functions
17. Controllability and observability
18. Properties of state feedback and state feedback design

Computer Usage

High

Laboratory Experience

None

Design Experience

High

Coordinator

Tarek Mohammad, Ph.D.

Date

27 March 2018