ECE 58400 – Linear Control Systems

Type of Course
Core course for the EE option of the MSE program

Catalog Description
Linear spaces and linear operators, mathematical representations of linear systems, canonical forms, state space description, controllability, observability, realization, canonical decomposition, stability, introduction to Lyapunov methods, eigenstructure assignment, partial and full order observers, disturbance decoupling.

Credits
3

Contact Hours
3

Prerequisite Courses
ECE/ME 33300 or graduate standing

Corequisite Courses
None

Prerequisites by Topics
Exposure to linear algebra and matrices. The student is expected to have seen the following topics: matrices and vectors, (introductory) linear algebra; differential equations, Laplace transform, transfer functions. Exposure to topics such as control systems, circuits, signals and systems, or dynamics is not required, but can increase student's appreciation.

Textbook
Linear System Theory & Design, by Chi-Tsong Chen, Oxford Press, 3rd Ed., 1999.

Course Objectives
Introduction to applied linear algebra and linear dynamical systems with applications to circuits, signal processing, communications, and control systems. Stability, controllability, and observability. Realizability and minimal realization theory. State feedback and state estimators. Pole placement and model matching.

Course Outcomes
Students who successfully complete this course will have demonstrated an understanding of:

1. State space representation of linear time-invariant systems

2. Solution using the state space data
3. Similarity transformation and Jordan form
4. Stability analysis using the Lyapunov function
5. Controllability and observability
6. State feedback design
7. State estimator design
8. Pole placement design and model matching.
9. Mapping between course outcomes to program student learning outcomes

Lecture Topics

1. Linear algebra with applications
2. Mathematical descriptions of systems
3. Response of linear systems
4. Stability
5. Controllability, observability, and canonical forms
6. Realization theory and algorithms
7. State feedback
8. State observation
9. Pole placement and model matching

Computer Usage

High

Laboratory Experience

None

Design Experience

High

Coordinator

TBD

Date

10/01/2018