

**University of Massachusetts  
Department of Electrical &  
Computer Engineering  
Amherst, MA 01003**

Course Instructor: **R. Janaswamy**  
Date of Outline Preparation: **01/21/2020**  
Prepared by: **R. Janaswamy**

## ECE 604: Linear Systems Theory (3-0), Spring 2020

### 1. Catalog Data:

Linear dynamical systems and state variables; difference and differential equations; vectors and vector spaces, linear independence and bases, rank and degeneracy, linear operators, eigenvalues, eigenvectors; linear functionals, matrix functions, quadratic form, Jordan form; Liapunov functions and stability; solutions to state equations.

### 2. Course Objective:

The objective of the course is to give the student an understanding of the characterization and design of a linear dynamic system through state variable approach.

### 3. Text and References:

Text: *Linear System Theory*, Wilson J. Rugh, Prentice-Hall, 1996, ISBN: 0-13-441205-2.

### 4. Required Background Experience:

1. Matrix theory and linear algebra.
2. Ordinary differential equations.
3. Transform methods.

### 5. Detailed Description of the Course

A. Review of Linear Algebra: Ch 1	3 lecs
B. Examples of Linear Systems: Ch. 2	3 lecs
C. Solution of Linear State Equations: Chs. 3, 4	9 lecs
D. Time Invariant and Periodic Systems: Ch. 5	6 lecs
E. Stability Criteria, Chs. 6-8	6 lecs

F. Controllability and Observability, Ch. 9	6 lecs
G. Kalman Filter, Instructor's notes plus references	6 lecs
H. No Classes (2/17, 4/20, 3/16-3/20)	

TOTAL                    39 lecs

**6. Method of Instruction and Evaluation**

A lecture mode of instruction will be used. One midterm (40%, take-home, around week of March 09) and a final exam (40%, take-home around May 01) are planned for the course. Homeworks will be assigned periodically and carry 20% of grade. No late homeworks will be entertained.

**7. Computer Usage:**

Familiarity with MATLAB or other computing software is desirable.

**8. Lecture Room:**

ELAB 325, MWF 10:10-11:00

**9. Office Hours:**

M, W: 13:30-14:30, Marcus 215-D

**10. Course Website:** Moodle at <https://moodle.umass.edu/course/>