

# ELEG 5413 Modern Control Systems

## Summer 8W2 2021 Syllabus

**Instructor:** Roy McCann, Ph.D., P.E.

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### **Textbook (Required):**

Control Systems Design by Bernard Friedland (Dover) ISBN-13: 978-0486442785

(Optional) Modern Control Systems by Dorf and Bishop (from ELEG 5403) ISBN-13: 978-0136024583.

Additional Reference (selected items will be posted by the instructor): Linear State-Space Control Systems by William and Lawrence, 2007 Wiley ISBN: 978-0-471-73555-7

### **Prerequisite: ELEG 5403 or instructor permission Control Systems**

This is the second course in a two-course sequence in control systems. ELEG 5413 extends the theory developed for linear systems covered in ELEG 5403 (transfer functions, Bode plots, lead-lag and PID) to include multiple-input multiple output systems, hybrid systems (discrete-time and digital systems interfaced to continuous-time analog systems) and commonly encountered nonlinear effects. This course has applications to many areas of design engineering. We will employ Matlab-Simulink throughout the course for both analysis and design. Applications will focus on robotics, power electronics, motor drives, power systems and biomedical & physiological dynamics. The design project is intended to demonstrate the design and analysis concepts with application to practical engineering objectives.

### **Topics:**

#### **1. Analysis**

- a. State-space mathematical modeling and analysis of dynamic systems
- b. Observability and Controllability
- c. Transformations

#### **2. Design**

- a. Pole Placement
- b. Observers
- c. Regulation and tracking control
- d. Introduction to optimization

### **Grading:**

- Homework #1 through #6 (10% each): 60% total
- Test 1: 15%
- Design Project (Matlab): 25%

**Approximate Grade Assignment: > 90% - A**

**> 80% - B**

**> 70% - C**

**< 60% - D or F if incomplete assignments**

**ABET Content: 50% Analysis, 50% Design**

**Online Class: Weekly video conferences are scheduled for Tuesdays at 6:30pm central time zone.**

<b>Week Number</b>	<b>Assignment</b>	<b>Videos (2015)</b>	<b>Friedland Textbook Sections</b>
<b>1 - Oct. 13</b>	<b>HW-1 Due 10/21</b>	<b>2/2 - 2/6</b>	<b>2.1-2.4, 3.1-3.6</b>
<b>2 - Oct 18</b>	<b>HW-2 Due 10/28</b>	<b>2/9 - 2/18</b>	<b>5.1-5.3</b>
<b>3 - Oct 25</b>	<b>HW-3 Due 11/4</b>	<b>2/20/2/25</b>	<b>5.4, 6.1-6.3</b>
<b>4 - Nov 1</b>	<b>HW-4 Due 11/11 (test 1)</b>	<b>2/27 - 3/9</b>	<b>6.4-6.5</b>
<b>5 - Nov 8</b>	<b>HW-5 Due 11/18</b>	<b>3/10-3/29</b>	<b>7.1-7.4, 8.1-8.2</b>
<b>6 - Nov 15</b>	<b>HW-6 Due 11/29</b>	<b>3/30 - 4/6</b>	<b>8.4-8.5</b>
<b>7 - Nov 22</b>	<b>Design Project</b>	<b>4/13 - 4/24</b>	<b>9.1-9.5</b>
<b>8 - Nov 29</b>	<b>Design Project</b>		
<b>9 - Dec 6</b>	<b>Design Project Due</b>	<b>Dec 16</b>	
		<b>All Assignments must turned in no later than Dec 16 @ 11:59pm</b>	