

Course Syllabus
MECH 4310 Systems and Controls
(Fall 2016)

Course Information

<i>Course Number/Section</i>	MECH4310.001.16F
<i>Lecture Days & Times</i>	Tuesdays & Thursdays: 2:30pm-3:45pm
<i>Classroom</i>	ECSS 2.415

Instructor Information

<i>Instructor</i>	Prof. Yaoyu Li
<i>Office Phone</i>	(972) 883-4698
<i>Email Address</i>	yaoyu.li@utdallas.edu
<i>Office Location</i>	ECSN 3.210
<i>Office Hours</i>	Tuesdays and Thursdays 11:00 a.m. – 12:30 p.m.

TA Information

<i>Teaching Assistant</i>	Mr. Fenglin Zhou
<i>Email Address</i>	fxz160030@utdallas.edu
<i>Office Location</i>	ECSN 2.124
<i>Office Hours</i>	Mondays 10:00 a.m. ~ noon.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

Pre-requisite: MECH 3302 & MECH 3310

Course Description

MECH 4310 Systems and Controls (3 semester hours) Lecture course. Introduction to linear control theory. General structure of control systems. Mathematical models including differential equations, transfer functions, and state space. Control system characteristics. Transient response, external disturbance, and steady-state error. Control system analysis. Performance, stability, root-locus method and Bode diagram. Control system design. Compensator design.

Student Learning Objectives/Outcomes

- Derive and analyze dynamic models of mechanical, electrical and electromechanical systems ABET outcomes (a, e, k)
- Explain the concept of feedback control system and its purpose. ABET outcomes (e, j)
- Analyze stability and performance of control systems in time domain. ABET outcomes (a, e, k)
- Analyze stability and performance of control systems in the frequency domain. ABET outcomes (a, e)
- Ability to describe a dynamic system using differential equations, transfer functions and state matrices (a, e)
- Ability to find a state feedback controller (a, e, k)

Required Textbooks and Materials

- Richard C. Dorf and Robert H. Bishop, *Modern Control Systems – 12th ed.*, 2010, Prentice Hall.
- Access to Matlab (note: access is available in the computer labs).

Userful Reference Materials

- Matlab/Simulink User Guides (<http://www.mathworks.com/help/techdoc/>)
- University of Michigan. *Control Tutorials for MATLAB*, <http://www.engin.umich.edu/group/ctm/>

- Tewari, A. *Modern Control Design with MATLAB and SIMULINK*, 2002, Wiley.
- Klee, H. and Allen, R. *Simulation of Dynamic Systems with MATLAB and Simulink*, 2nd ed., 2011, CRC Press.

Course Contents on Academic Calendar

- Introduction to dynamic systems and controls;
- Review of Laplace transforms and complex numbers; linearity and superposition;
- Modeling of mechanical, electrical and electromechanical systems in ordinary differential equations;
- Transfer functions and block diagrams;
- Introduction to state variables & state-space models;
- Time response of dynamic systems to input commands, disturbances & noises; poles & zeros;
- Frequency response and Bode plots;
- Stability concept and Routh criterion;
- Basic properties of feedback;
- System type; steady-state errors; sensitivity;
- PID controller; Ziegler-Nichols method for tuning PID controllers;
- Root locus method for controller design and stability analysis;
- Bode plots for stability analysis and controller design; stability margins;
- Dynamic compensator design.

Course Load & Grading Plan

- **Homework Assignments** (11-12 assignments): 40%
- **Exam #1** (In Class - Thursday October 6, 2016): 15%
- **Exam #2** (In Class - Thursday November 10, 2016): 20%
- **Exam #3** (TBD): 25%

Course Information Platform: UTD eLearning.

Course Policies

Late Work

Not accepted except for extreme circumstances

Class Attendance

Roll will be taken on occasion & pop quizzes will be given

Classroom Citizenship

Professional / University standards will be followed. Evidence of plagiarism will be reported to the relevant administration of university.

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the instructor.