Course Syllabus

MECH 4310 Systems and Controls

(Fall 2015)

Course Information

Course Number/Section	MECH4310.001.15F
Lecture Days & Times	Tuesdays & Thursdays: 2:30pm-3:45pm
Classroom	JSOM 1.217

Instructor Information

Instructor	Prof. Yaoyu Li
Office Phone	(972) 883-4698
Email Address	yaoyu.li@utdallas.edu
Office Location	ECS.N 3.210
Office Hours	Thursdays 11:00 a.m. - noon and Fridays 2:30 p.m. – 3:30 p.m.

TA Information

Teaching Assistant	Mr. Sai Pradyoth Lakshmane Gowda
Email Address	sxl144130@utdallas.edu
Office Location	ML2 1.214
Office Hours	Wednesdays 1:30 p.m. – 4:00 p.m.

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;
- 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;
- Introduction to state variables & state-space models.

Course Load & Grading Plan

- **Homework Assignments** (10-11 assignments): 40%
- **Exam #1** (TBD, Late September ~Early October): 15%
- **Exam #2** (TBD, Late October ~ Early November): 20%
- **Exam #3** (Tuesday December 8, 2015): 25%
  Note: Exact Exam Dates will be announced no less than two weeks before the exam.

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.