Control Theory B - Course Syllabus

Course Number: ME 221B

Course Title: Control Theory B

Academic Semester:	Summer	**Academic Year:**	2015/ 2016
Semester Start Date:	June 6, 2016	**Semester End date:**	August 4, 2016

Class Schedule: Mondays, Thursdays from 2 PM to 5 PM

Instructor(s) Name(s): Abubakr Muhammad
Email: abubakr.muhammad@gmail.com

Teaching assistant name: TBA
Email:

Office Hours: Mon 10am-11am, Tuesdays 2pm-3pm

COURSE DESCRIPTION AS PER AS PROGRAM GUIDE

Prerequisite: Undergraduate Calculus of One and Several Variables, Linear Algebra, Differential Equations, Probability and Statistics or equivalents; AMCS 201 and AMCS 202 or equivalent may be taken concurrently; ME 221b requires ME 221a.
An introduction to analysis and design of feedback control systems, including classical control theory in the time and frequency domain. Modeling of physical, biological, and information systems using linear and nonlinear differential equations. Linear vs. nonlinear models, and local vs. global behavior, Input/output response, modeling and model reduction, Stability and performance of interconnected systems, including use of block diagrams, Bode plots, the Nyquist criterion, and Lyapunov functions. Robustness and uncertainty management in feedback systems through stochastic and deterministic methods. Basic principles of feedback and its use as a tool for altering the dynamics of systems and managing uncertainty methods. Introductory random processes, Kalman filtering, and norms of signals and systems.

COMPREHENSIVE COURSE DESCRIPTION

The course prepares students to do independent work at the frontiers of systems theory and control engineering. The course builds further on standard linear systems theory to explore issues related to optimization, estimation and adaptation. Students will learn to formulate and appreciate fundamental limitations in control, filtering and estimation..

Topics include review of linear control systems, static constrained optimization, calculus of variations, dynamic optimization, Bellman’s principle of optimality, Maximum principle, twopoint boundary value problems and Riccati equations, linear quadratic regulater (LQR), learning and adaptation in controllers, policy- and value-iteration.

LEARNING OUTCOMES

The students should be able to:

- Understand fundamental limits of control & estimation
- Use advanced mathematical techniques to formulate and solve control problems
- Appreciate issues of robustness, optimality, architecture and uncertainty in control problems
- Identify practical challenges in posing control problems

REQUIRED KNOWLEDGE / PREREQUISITES

Courses: EE271A or equivalnet or by permission of instructor
Topics: linear algebra, differential equations, signals and systems.

METHOD OF EVALUATION

Assessment Module	Number	Weightage
Mid-term Exam	1	25%
Homework	4	24%
Term Paper	1	21%
Final Exam	1	30%

REFERENCE TEXTS

The course will be taught from a combination of textbooks and course notes. The following books and course notes will be used as reference.

- Dynamic Optimization by Arthur Bryson. Addison Wesley. 1999.
- Optimization Based Control. Course notes by Richard Murray. 2010.
- Notes on Optimal Control and Linear Quadratic Problems by Bassam Bameih. 2001.

COURSE POLICIES

All homework assignments, and exams are required. Students who do not show up for a an exam should expect a grade of zero on that exam. If you dispute your grade on any homework, quiz, or exam, you may request a re-grade (from the TA for the homeworks and quizzes or from the instructor for the exams) only within 48 hours of receiving the graded exam. Incomplete (I) grade for the course will only be given under extraordinary circumstances such as sickness, and these extraordinary circumstances must be verifiable. The assignment of an (I) requires first an approval of the dean and then a written agreement between the instructor and student specifying the time and manner in which the student will complete the course requirements.

NOTE

The instructor reserves the right to make changes to this syllabus as necessary.