



Lahore University of Management Sciences

EE361 – Feedback Control Systems EE361L – Feedback Control Laboratory Spring 2014

Instructors	Abubakr Muhammad Momin Uppal
Room No.	9-351A
Office Hours	TBA
Email	abubakr@lums.edu.pk
Telephone	+92 (42) 3560-8132
Secretary/TA	TBA
TA Office Hours	TBA
Course URL (if any)	http://cyphynets.lums.edu.pk/index.php/EE-361

Course Basics				
Credit Hours	4 (3+1)			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	1hr-15min each
Recitation/Lab (per week)	Nbr of Lec(s) Per Week	1 (Lab)	Duration	2hr 30min
Tutorial (per week)	Nbr of Lec(s) Per Week	1	Duration	50 min

Course Distribution	
Core	Electrical Engineering
Elective	
Open for Student Category	
Close for Student Category	

COURSE DESCRIPTION
Design of linear feedback control systems for command-following, disturbance rejection, stability, and dynamic response specifications. Root-locus and frequency response design (Bode) techniques. Nyquist stability criterion. Design of dynamic compensators. State-space methods. Digitization and computer implementation issues. Integrated laboratory exercises on practical applications of control.

COURSE PREREQUISITE(S)
EE-310. Signals and Systems.

COURSE OBJECTIVES
<ul style="list-style-type: none">• Use of control for achieving desired behavior in unstable and uncertain systems.• Advantages and disadvantages of feedback in a system.• Open- and closed-loop control and their respective merits/demerits.• Stability and its relationship with feedback.• Techniques of linear time-invariant (LTI) control system design.• Pervasiveness of feedback and control in science & engineering.• Systems engineering tools for solving complex problems.

Learning Outcomes
<ul style="list-style-type: none">• Model physical systems, sensors and actuators in various settings using the language of signals and systems.• Identify state, measurement and control in a given problem.• Design controllers for linear models of systems using MATLAB and SIMULINK.• Implement digital controllers for various mechanical and electrical systems.• Predict and test control system performance.



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Grading Breakup and Policy	
Home Work: 8%	
Quiz(s): 7%	
Midterm Examination: 30%	
Final Examination: 35 %	
Lab Performance: 20 %	

Examination Detail	
Midterm Exam	All Sections Combined Duration: 2 hrs Exam Specifications: Closed book, closed notes, help-sheet and calculators allowed
Final Exam	All Sections Combined Duration: 3 hrs Exam Specifications: Closed book, closed notes, help-sheet and calculators allowed

COURSE OVERVIEW			
Modules	Topics	Recommended Readings	Objectives/ Application
•	Review of signals and systems; Laplace transform; block diagrams.		
•	Mathematical modeling of physical systems; state space and transfer functions.		
•	Feedback as a fundamental concept; control specifications and dynamic response.		
•	PID controllers.		
•	Root locus design.		
•	Frequency response methods/ Nyquist criterion; Lead/Lag compensators.		

Textbook(s)/Supplementary Readings
<p>The course will be taught from :</p> <p>Feedback control of dynamical systems by Franklin, Powell and Emami-Naeini, Prentice Hall, 2006.</p> <p>Other important references include</p> <ol style="list-style-type: none"> 1) <i>Feedback Systems: An Introduction for Scientists and Engineers</i> by Karl Astrom and Richard Murray, Princeton University Press, 2008. 2) <i>Signals and Systems</i> by Alan V. Oppenheim, Alan S. Willsky with S. Hamid, 2nd edition, Prentice Hall, 1997.

Labs

Venue. Control Systems Lab, 3rd Floor SSE Bldg

Frequency. 3 hr, weekly sessions in groups of 3 students

Lab Topics.

Intro to SIMULINK and MATLAB toolboxes, motor position and speed control, control of thermal systems, control of inverted & magnetic pendulums, system identification techniques, digital controller synthesis, observer design, anti-windup, digital and analog control techniques.