Course Title	Control Systems Theory & Laboratory				
Course Code	ECE401				
Course Type	Compulsory				
Level	Bachelor (1st Cycle)				
Year / Semester	4th Year / 7th Semester				
Teacher's Name	TBA				
ECTS	12	Lectures / week	3 hours / 14 weeks	Laboratories / week	3 hours / 14 weeks
Course Purpose and Objectives	The objective of this course is to expose students to feedback control principles of both linear and non-linear systems in terms of transient and steady state response and stability. Students are also presented to a range of mathematical models of typical engineering systems to be controlled and learn to design feedback control systems with Laplace, Nyquist and Bode plots.				
Learning Outcomes	Upon successful completion of this course, students should be able to: • Apply concepts of feedback control in open and closed loop systems using state-space, transfer function and root-locus techniques • Perform mathematical modeling on engineering systems • Perform transfer function analysis based on Laplace transform theory • Interpret the stability of a closed-loop control system from the Routh-Hurwitch criteria • Apply root locus and frequency response techniques to analyse and design feedback systems • Analyse simple Proportional, Integral and Derivative (PID) controllers on the static and transient characteristics of control systems • Assess the steady state and dynamic properties of a system • Use simulation software such as MATLAB for the design of control systems				
Prerequisites	ECE230	Co-requisites	None		
Course Content	Introduction: Overview of control system components. Control System design. Open loop and closed loop systems. Analysis of linear systems and feedback: Laplace Transforms, properties and theory of Laplace Transform. Using Laplace Transforms to solve Differential Equations, Transfer Functions. Step and impulse responses. Properties of 1st and 2nd order systems: Stability of open- and closed-loop systems. Stability tests based on the Routh Array. Root-locus analysis and design. System poles and zeros.				

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<tr><td></td><td>Frequency response methods:
Nyquist anaylsis and design, robust stability.

PID control and non-linear systems:

Various compensator structures including phase lead and phase lag, proportional, integral and derivative action. Non-linear systems and feedback effect.

Laboratory part

The laboratory part of the course provides students with hands-on experience on the operation of simple closed-loop control systems. It comprises of a set of experiments which complement the theoretical material covered in class. The experiments focus on control systems, controllers and control circuits.</td></tr>
<tr><td>Teaching Methodology</td><td>Face- to- face</td></tr>
<tr><td>Bibliography</td><td>K. Ogata, Modern Control Engineering, Prentice Hall

R.C. Dorf and R.H. Bishop, Modern Control Systems, Prentice Hall

G.F. Franklin, J.D. Powell A. Emani-Naeini, Feedback Control of Dynamic Systems

Modulsystem Regelungstechnik (Serie 9500) User Manual</td></tr>
<tr><td>Assessment</td><td><table><tr><td>Examinations</td><td>55%</td></tr><tr><td>Assignments/Lab</td><td>35%</td></tr><tr><td>Class Participation and Attendance</td><td>10%</td></tr><tr><td></td><td>100%</td></tr></table></td></tr>
<tr><td>Language</td><td>English</td></tr>
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