UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
ECE-364	Control Systems	6
Prerequisites	**Department**	**Semester**
ECE-331	Engineering	Spring
Type of Course	**Field**	**Language of Instruction**
Required	Engineering	English
Level of Course	**Lecturer(s)**	**Year of Study**
1st Cycle	Dr Ioannis Kyriakides	3rd
Mode of Delivery	**Work Placement**	**Corequisites**
Face-to-face	N/A	None

Course Objectives:

The main objectives of the course are to:

- Provide solid knowledge foundation on feedback control principles.
- Introduce fundamental analysis tools using state variable and frequency response methods for determining control system performance.
- Develop skills for the design of feedback control systems.

Learning Outcomes:

After completion of the course students are expected to be able to:

- Use ordinary differential equations to model simple electrical and mechanical systems.
- Represent linear time-invariant systems in both time and frequency domains using state variable models, transfer functions, block diagrams and signal-flow graphs.
- Compute the system response characteristics; determine transient response, steady-state response and steady-state errors.
- Perform absolute and relative system stability analysis.
- Use the root-locus technique and Nyquist's criterion to analyze systems.
- Have the necessary skills for designing PID, phase-lead, and phase-lag controllers using root-locus and Bode plots.
- Design a feedback control system to meet specified objectives.
- Use design and simulation software such as MATLAB.

Course Content:

- Mathematical modeling of control systems, Laplace transform, transfer function, block diagrams, signal-flow graphs, state variable models, state differential equation, time response, state transition matrix.
- Feedback control system characteristics such as sensitivity, disturbance signals, and steady-state error.
- Feedback control systems performance: test input signals, second-order system performance, damping ratio, transient response measures (rise time, peak time, percent overshoot, settling time), steady-state error, and performance indices.
- The concept of absolute stability, Routh-Hurwitz criterion, relative stability, stability of state variable systems, stability in the frequency domain, Nyquist stability criterion, gain and phase margins.
- The root locus procedure as a tool for analyzing and designing feedback control systems, parameter design, sensitivity of the roots to parameter variations, PID controllers
- Frequency response using polar plots and Bode diagrams, log magnitude and phase diagrams. Concepts of design and compensation of feedback control systems, phase lead and phase lag design using Bode diagram and root locus.

Learning Activities and Teaching Methods:

Lectures, in-class examples and exercises.

Assessment Methods:

Homework, exams, final exam.

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Modern Control Systems	R. C. Dorf R. H. Bishop	Prentice Hall	2008	0132270285

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Feedback Control of Dynamic Systems	G. F. Franklin J. D. Powell A. Emami Naeini	Prentice Hall	2006	0131499300