Course Syllabus

Course Code	Course Title	ECTS Credits
MENG-342	Systems and Control Engineering	6
Prerequisites	**Department**	**Semester**
MATH-330	Engineering	Fall, Spring
Type of Course	**Field**	**Language of Instruction**
Required	Engineering	English
Level of Course	**Lecturer(s)**	**Year of Study**
1st Cycle	Dr Harry Iordanou	3rd
Mode of Delivery	**Work Placement**	**Corequisites**
Face-to-Face	N/A	None

Course Objectives:

The main objectives of the course are to:

- Present the modeling of mechanical, electrical, and other linear time-invariant (LTI) dynamic systems both in the time domain as well as and in the Laplace domain.
- Provide an understanding of the stability concept, transient and steady-state response of dynamic systems and their impact on performance of electromechanical systems.
- Introduce feedback control and provide understanding how feedback impacts transient and steady-state performance.
- Teach how to design feedback control systems to meet given performance specifications.
- Familiarize with proportional-integral-derivative (PID) control.
- Introduce the frequency response methods to the design of LTI systems and how this approach relates to the transient and steady-state system performance.
- Familiarize with the analytical methods and tools used in control system analysis and design.
- Develop ability to use software tools for the analysis and design of control systems.
- Introduce the state-space representation of LTI systems and the related control system analysis/design methodologies.

Learning Outcomes:

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

- Describe the methodology for modeling dynamic systems (electrical, mechanical, etc.)
- Demonstrate the transfer function approach to represent linear systems through Laplace transforms.
- Interpret state-space models and their relation to frequency domain models.
- Illustrate the fundamental characteristics and properties of feedback control systems.

- Recall the methods of Routh-Hurwitz, root-locus, Bode, and Nyquist in the analysis and design of control systems.
- Show how computer software can be used for the analysis and design of control systems.
- Calculate the tuning parameters for feedback controllers and compensators to achieve desired performance specifications.

Course Content:

- Overview and history of feedback (closed-loop) control.
- Modeling of mechanical, electrical, and other dynamic systems.
- Dynamic system response (Laplace transforms, transfer functions, poles/zeros, dynamic response, time-domain specifications, stability).
- Feedback properties and the Proportional-Integral-Derivative controller.
- Root locus analysis and design.
- Frequency response design method using Bode plots and Nyquist plots.
- State-space design methods.

Learning Activities and Teaching Methods:

Lectures, In-class examples, exercises.

Assessment Methods:

Homework, exams, final exam.

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Feedback Control of Dynamic Systems	Gene F. Franklin, J. David Powell, Abbas Emami-Naeini	Pearson	2014	1292068906

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Modern Control Systems	Richard C. Dorf, Robert H. Bishop	Pearson	2013	1292024054
Modern Control Engineering	Katsuhiko Ogata	Pearson	2008	0137133375