UNIVERSITY OF SHARJAH

**College of Engineering**

**Department of Electrical Engineering**

# Feedback Control Systems

## Course Description:

This course provides an introduction to linear control systems, open-loop and closed-loop control systems. It covers different mathematical representations of linear time-invariant systems such as differential equations, transfer function, and state space equations. It includes the time response and performance analysis of feedback control systems. It provides the basic tools for stability analysis using Routh-Hurwitz method, Bode and Nyquist diagrams. It covers control design techniques such as root locus method, state feedback control technique, and PID controllers.

## Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Develop a mathematical model of electrical/mechanical linear systems in time domain.
2. Develop a mathematical model of electrical/mechanical linear systems in frequency domain.
3. Analyze the time domain stability of the dynamic systems.
4. Analyze the frequency domain stability of the dynamic systems.
5. Design feedback controllers for linear time-invariant systems.

## Alignment of Course Student Learning Outcomes to Program Student Learning Outcomes

| SN | Program SLOs | Course SLOs |
|---|---|---|
| **(1)** | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics | - Develop a mathematical model of electrical/mechanical linear systems in time domain.<br>- Develop a mathematical model of electrical/mechanical linear systems in frequency domain.<br>- Analyze the time domain stability of the dynamic systems.<br>- Analyze the frequency domain stability of the dynamic systems.<br>- Design feedback controllers for linear time-invariant systems. |

| SN | Program SLOs | Course SLOs |
|---|---|---|
| **(2)** | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. | - Develop a mathematical model of electrical/mechanical linear systems in time domain.<br>- Develop a mathematical model of electrical/mechanical linear systems in frequency domain.<br>- Analyze the time domain stability of the dynamic systems.<br>- Analyze the frequency domain stability of the dynamic systems.<br>- Design feedback controllers for linear time-invariant systems. |
| **(3)** | Communicate effectively with a range of audiences | |
| **(4)** | Describe ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts | |
| **(5)** | Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives | - Develop a mathematical model of electrical/mechanical linear systems in time domain.<br>- Develop a mathematical model of electrical/mechanical linear systems in frequency domain. |
| **(6)** | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions | - Develop a mathematical model of electrical/mechanical linear systems in time domain.<br>- Develop a mathematical model of electrical/mechanical linear systems in frequency domain.<br>- Analyze the time domain stability of the dynamic systems.<br>- Analyze the frequency domain stability of the dynamic systems.<br>- Design feedback controllers for linear time-invariant systems. |
| **(7)** | Apply new knowledge as needed, using appropriate learning strategies | |