Course Title	Course Code	Credit Hours
Control Engineering	ME-229	2 – 0

Textbook:

- Charles Phillips & Royce Harbor, Feedback Control Systems, Prentice-Hall

Reference Books:

- Katsuhiko Ogata, Modern Control Engineering.
- Norman S Nise, Modern Control Engineering.

Course Objective:

Develop proficiency in designing and optimizing control systems to enhance engineering processes and system performance.

Course Outline:

- Introduction. Basics of control system, Open-loop and closed-loop control systems,Block diagram terminology, Example of system for block diagrams, Signal flow graphs
- Dynamic System modeling. Mechanical Translational & Rotational Systems, Electrical Active & Passive Systems, Electromechanical Systems, Conversion of Electrical System to Equivalent Mechanical Systems and vice versa, Thermal system and fluid systems
- Laplace Transforms and Transfer Function. Mason Gain Formula to find transfer function, Mason's formula application of electrical and mechanical systems, Development of nodal equations from signal flow graph, Development of signal flow graph from nodal equations
- State Space Formulation. State space formulation from differential equations, State Space formulation from block diagram and signal flow graphs, Control and Observer Canonical form of block diagrams and state space, Types of inputs like impulse, step, ramp and sinusoidal input, Solution of state space for different responses, System linearization and its applications.
- Time Response of 1^{st} Order and Higher Order2^{nd} Order System. Time response of the 1^{st} and 2^{nd} order systems (impulse, step, ramp etc.), Time response characteristics, Frequency response of 1^{st} and 2^{nd} order systems, Time response of higher order systems
- Study of System Stability. Introduction to stability, Poles and Zeros concept, Ruth-Hurwitz stability criteria and its applications, Concept of Root-Locus
- • Root Locus Design. Root Locus design, System stability by pole placement, Compensator Design (Lead and Lag Compensator), Design of PID Controller (P, PI and PID Controllers), Different PID Controller Tuning method
- • Frequency Design. Introduction to frequency plots, Bode Plots, System Stability using Bode Plot

Description	Percentage Weightage (%)
Assignments	05-10%
Quizzes	10-15%
Mid Semester Exams	30-40%
End Semester **ASSESSMENTS** Exam	40-50%