

**DEPARTMENT OF ELECTRONICS**  
**MSc Electronics**  
**ELS 456 - CONTROL SYSTEM**

**Unit I**

**10 Hours**

Introduction to Control Systems: Introduction to control Systems, Closed-Loop Control Versus open-Loop Control, Design and Compensation of Control Systems.

Mathematical Modelling of Control Systems: Introduction, Transfer Function and Impulse-Response Function, Automatic Control Systems, Modelling in State Space, State-Space Representation of Scalar Differential Equation Systems

Mathematical Modeling of Mechanical Systems and Electrical Systems: Introduction, Mathematical Modelling of Mechanical Systems, Mathematical Modelling of Electrical Systems

**Unit II**

**10 Hours**

Control Systems Analysis and Design by the Root-Locus Method: Introduction, Root-Locus Plots Root-Locus Plots of Positive Feedback Systems, Root-Locus Approach to Control-Systems Design, Lead Compensation, Lag Compensation, Lag–Lead Compensation, Parallel Compensation

Control Systems Analysis and Design by the Frequency-Response Method: Introduction, Bode Diagrams, Polar Plots, Log-Magnitude-versus-Phase Plots, Nyquist Stability Criterion, Stability Analysis, Relative Stability Analysis, Closed-Loop Frequency Response of Unity-Feedback Systems, Experimental Determination of Transfer Functions, Control Systems Design by Frequency-Response Approach, Lead Compensation, Lag Compensation, Lag–Lead Compensation.

**Unit III**

**10 Hours**

PID Controllers and Modified PID Controllers: Introduction, Ziegler–Nichols Rules for Tuning PID Controllers, Design of PID Controllers with Frequency-Response Approach, Design of PID Controllers with Computational Optimization Approach, Modifications of PID Control Schemes, Two-Degrees-of-Freedom Control, Zero-Placement Approach to Improve Response Characteristics,

Control Systems Analysis in State Space: Introduction, State-Space Representations of Transfer-Function Systems, Solving the Time-Invariant State Equation, Some Useful Results in Vector-Matrix Analysis, Controllability, and Observability.

**Text book:**

1. “Modern Control Engineering” Katsuhiko Ogata. Pearson publication, Fifth Edition

**Reference book:**

1. “Control Systems Engineering”. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, Second Edition