EEE302 Control Systems - I (2 Units)

- Introduction: Basic concepts, definition, examples of control systems. Open-loop and closed-loop control systems. Review of Laplace and inverse Laplace transforms.
- System modeling: Signal flow graph, block diagram. Transfer function. Block diagram reduction using signal flow graph and block diagram reduction techniques. Mechanical, electrical and electro-mechanical systems. First and second order models, higher order models.
- Definitions of transient response parameters. Analysis of second-order system as prototype. Feedback, Time response analysis, concept of stability. Routh-Hurwitz stability criterion. Classification of systems based on steady-state characteristics, steady-state error coefficient.
- Definition of Root locus, Properties of root locus, sketching of root locus plots. Effect of open-loop zeros and poles. Root locus design concepts. Frequency response analysis and design: Bode diagram, Polar plot, Nichols plot.
- Nyquist stability criterion: non-mathematical description of Nyquist criterion, interpretation of stability. Relative stability - Gain and phase margins. Closed-loop frequency response analysis - M and N contours, Nichols chart. Compensation techniques: lag, lead and lag-lead compensation, PD, PI and PID controllers. Cascade compensation based on root-locus method. Introduction to Feedback compensation.
- Computer-aided design and analysis of control system.