GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Electrical Engineering

Subject Name : NON-LINEAR CONTROL SYSTEMS (Control Group)

Sr.No	Course content
1.	Describing Function Analysis of Nonlinear Control System: Introduction to Nonlinear Systems, Describing Functions for Common Types of Nonlinearities, Describing Function Analysis, Stability and Limit Cycles.
2.	Phase Plane Analysis: Introduction: Analytical Methods for constructing Trajectories, Graphical Methods for constructing Trajectories; Isocline Method; Delta Method; Pell's Method; Lienard's Method; Classification of Singular Points; Limit Cycles; Phase-Place Analysis of Linear control system; Phase-plane Analysis of Non-linear control system. Minimum Time Trajectory; Optimum Switching Curve. Poincare-Bendixson Theorem.
3	Input-output analysis and stability: Small gain theorem, passivity, describing functions.
4	Mathematical background: Contraction mapping theorem, homeomorphisms, norms.
5	Lyapunov stability theory: Basic stability and instability theorems. Uniform stability, asymptotic stability, exponential stability. LaSalle's Theorem, indirect method.
6	Feedback linearization: Input-output linearization, full-state linearization, stabilization, tracking. Zero dynamics, MIMO systems, non-minimum phase systems, singularities.
7	Sliding mode control: Sliding surfaces, differential inclusions, solutions in the sense of Filippov
8	Gain scheduling: Controller and scheduling design.

Reference Books :

1. S. Sastry, Nonlinear Systems: Analysis, Stability, and Control, Springer 1999.
2. H. Khalil, Nonlinear Systems, Prentice Hall, 2002.
3. Jean-Jacques E. Slotine, Weiping Li, Applied nonlinear control, Prentice Hall, 1991