GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Electrical Engineering

Subject Name: MODELLING AND SIMULATION OF DYNAMIC SYSTEMS (Control)

Sr.No	Course content
1.	Introduction Dynamics systems, Examples of dynamic; systems, Definitions related to dynamic systems, Classification of system inputs, classification of system models. System modeling and simulation.
2.	Modeling of Mechanical and Electrical Systems: Translational systems: Springs, Dampers, Mass, Rotational Systems: D'Alembert's Principle, Lagranges's Equation, Three dimensional motion Elective Systems: Basic Elements, Passive Circuit Analysis, Active circuit analysis: The operational amplifier Mechanics
3.	Fluid Systems: Properties of fluids: Density, equation of state, Liquids and Gases, Viscosity, Propagation of speed, Thermal properties, Reynolds Number Effects. Derivation of passive components, resistance, inductance and capacitance. Thermal System: Basic Effects, conduction, convection and Radiation, Circuit analysis of static thermal system: Signal and Multiple lumped capacitance modeling
4.	Transform Methods for Generalized Response: Impulse response, Convolution integral: Response to arbitrary inputs when impulse response is known, Frequency response, Response to periodic Inputs, transient inputs and random signal. Simulation Methods: Limitations of analytical methods, Analog Simulation. Digital Simulation: Specific Digital Simulation techniques
5.	Generalized Modeling Methods: Frequency response methods, Pulse testing methods, Random Signal testing methods, Parameter tracking methods, Multiple regression and least square methods, Subsystem Coupling Methods.
6.	Applications (Distributed Parameter Models) Longitudinal vibrations of a rod, Lumped Parameter approximations for rod vibration, Conduction heat translation in an Insulated Bar, Lumped parameter approximations for heat transfer in insulated bar. Magnetic Levitation system for an Experimental Rail vehicle.

Reference Books:

1. System Modeling and Response: Theoretical and Experimental Approaches. Ernest O. Dobling, John Wiley and Sons, 1980.
2. Modeling and Simulation of Dynamic Systems: Robert Woods, Kent L. Lawrence, PHI.

3. Simulation Modeling and Analysis: Averill M. Law, W. David Kelton. McGraw Hill
4. System Dynamics: Modeling Analysis, Simulation, Design: Ernest O. Dobling, Marcel Dekker Inc.
5. Modeling of Dynamical Systems Vol. I: H. Nicholson (Editor), Peter Peregrinus Ltd., on behalf of IEE (Useful for unit 6) 116842, 1980 Edition
6. Dynamic Modeling and Control of Engineering Systems: J. Lowen Sheaser, Bohan T. Kulawski Macmillan Publishing Company NY, 158275, 1990 Edition