

Devi Ahilya University, Indore, India Institute of Engineering & Technology				IV Year B.E. (Electronics & Instrumentation Engg.)				
Subject Code & Name		Instructions Hours per Week			Credits			
EIR7E3		L	T	P	L	T	P	Total
Advance Control System		3	1	2	3	1	1	5
Duration of Theory Paper: 3 Hours								

- **Learning objectives:** To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.

Prerequisites: Basic knowledge of control system.

Course Contents

Unit-I

STATE VARIABLE DESIGN

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control.

Unit-II

PHASE PLANE ANALYSIS

Features of linear and non-linear systems – Common physical non-linearities – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non linear systems – Isocline method.

Unit-III

DESCRIBING FUNCTION ANALYSIS

Basic concepts, Common Nonlinearities in Control Systems, Fundamentals, Describing Functions of Common Nonlinearities, Describing function analysis of non-linear systems.

Unit-IV

STABILITY ANALYSIS

Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane.

Unit-V

Simple Variable Structure Systems, Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems.

Learning Outcomes:

- Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems.
- Develop of state models for linear continuous – time and discrete – time systems.
- Apply vector and matrix algebra to find the solution of state equations for linear continuous – time and discrete – time systems.
- Define controllability and observability of a system and test for controllability and observability of a given system.
- Design pole assignment and state observer using state feedback.
- Develop the describing function for the nonlinearity present to assess the stability of the system.

Books Recommended:

- K. P. Mohandas, “Modern Control Engineering”, Sanguine Technical Publishers, 2006.
- G. J. Thaler, “ Automatic Control Systems”, Jaico Publishing House, 1993.
- M.Gopal, Modern Control System Theory, New Age International Publishers, 2002.