COURSE CODE	COURSE TITLE	L	T	P	C
1151AE106	LINEAR SYSTEM ANALYSIS AND CONTROL	3	0	0	3

Course Category:

Programme core

a. Preamble :

The course aims at developing the concepts of elements of control system, analysis and design techniques.

b. Prerequisite Courses:

- Transforms and Partial differential Equations

c. Related Courses:

- Airplane stability and control
- Navigation guidance and control

d. Course Educational Objectives:

- To understand the history and elements of control systems
- To familiarize with stability analysis and design of control systems.

e. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Describe fundamentals and Classify control system techniques	K2
CO2	Apply root locus technique to explain the concepts of stability in time domain	K3
CO3	Analyze the system stability using bode plots and Nyquist plot	K4
CO4	Summarize the concepts of control design	K5
CO5	Solve control system problems using state space approach	K3

f. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**			**H**		**H**	**H**	**H**		**H**		
CO2	**H**			**H**		**H**	**H**	**H**		**H**		
CO3	**H**			**H**		**H**	**H**	**H**		**H**		
CO4	**H**			**H**		**H**	**H**	**H**		**H**		
CO5	**H**			**H**		**H**	**H**	**H**		**H**		

H- High; M-Medium; L-Low

g. Course Contents:

UNIT-I INTRODUCTION & SYSTEM MODELLING L-9

Introduction, History of control systems, Needs and types of Mathematical models, Definitions of different control techniques - "Robust, Adaptive, Optimal &Intelligent control system", Transfer function, State variable Modelling, Conversation between state space and transfer function, Nonlinearities, Linearization.

UNIT-II TIME DOMAIN ANALYSIS L-9

Standard test signals, Time response of first order systems- Characteristic equation of feedback control systems, Transient response of second order systems - Time domain specifications - Steady state errors and error constants-effects of PD, PI systems. Concepts of stability - Routh's stability criterion - Root locus technique.

UNIT-III FREQUENCY RESPONSE ANALYSIS L-9

Introduction, Frequency domain specifications and transfer function from the Bode diagram - Phase margin and gain margin - Stability analysis from Bode Plots, Nyquist plot stability analysis.

UNIT-IV CONTROL DESIGN TECHNIQUE L-9

Compensation techniques - Lag, Lead, and Lead-Lag controllers design in time domain, PID controllers.

UNIT-V STATE SPACE ANALYSIS: L-9

Concepts of state, state variables and state models, derivation of state models from block diagrams, diagonalization - solving the time invariant state equations - State transition matrix and its properties - Concepts of controllability and observability, feedback, Pole placement.

Total Periods: 45

h. Learning Resources

i. Text Books:

1. Norman S. Nisei, "Control Systems Engineering", 7th Edition, John wiley and sons, 2015
2. Katsuhiko Ogata, "Modern Control Engineering", 5th edition, Pearson, 2009

ii. References:

1. Constantine H. Houpis, Stuart N. Sheldon, "Linear Control System Analysis and Design with MATLAB", 6th edition, CRC Press, 2013
2. M. Gopal, "Modern Control System Theory", 3rd edition, New Age International Publishers Ltd, 2014