VISAKHA INSTITUTE OF ENGINEERING & TECHNOLOGY
Approved by AICTE NEW DELHI
(Affiliated to JNTUGV, VIZIANAGARAM)
88th Division, Narava, GVMC, Visakhapatnam-530027
DIPLOMA | ENGINEERING | MANAGEMENT
NAAC NATIONAL ASSESSENT AND ACCREDITATION COUNCIL 'A' GRADE
ISO 9001:2015
COLLEGE CODE VSPT

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

LESSON PLAN

Course Code	Course Title	Year/Sem	Branch	Contact Hrs/Week	Section
R20	CONTROL SYSTEMS	**III/I**	**EEE**	**5**	**EEE**

COURSE OUTCOMES:

At the end of the course students are able to

CO1: Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
CO2: Determine time response specifications of second order systems and absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.
CO3: Analyze the stability of LTI systems using frequency response methods.
CO4: Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode diagrams.
CO5: Represent physical systems as state models and determine the response. Understand the concepts of controllability and observability.

Unit No.	Out Comes	TOPIC(S)		BOOK Reference	Total periods	Delivery Method	GATE/ IES
	UNIT I -Mathematical Modelling of Control Systems						
1	CO1:: To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function	1.1	Classification of control system	T1	15	Chalk & Talk, PPT, Active Learning , Smart board & Tutorial	
		1.2	open loop and closed loop control systems and their differences	T1			
		1.3	Feedback characteristics	T1			
		1.4	transfer function of linear system, differential equations of electrical networks	T1			
		1.5	translational and rotational mechanical systems	T1			
		1.6	transfer function of Armature voltage controlled DC servo motor	T1			
		1.7	block diagram algebra	T1			

		1.8	signal flow graph	T1			
		1.9	reduction using Mason's gain formula.	T1			
	UNIT II - Time Response Analysis and Controllers						
2	CO2: To analyze the time response of first and second order systems and improvement of performance using PI, PD, PID controllers. To investigate the stability of closed loop systems using Routh's stability criterion and root locus method.	2.1	Standard test signals	T1, T2	12	Chalk & Talk, PPT Tutorial, Active Learning Smart board&Case Study	
		2.2	time response of first and second order systems	T1, T2			
		2.3	time domain specifications	T1, T2			
		2.4	steady state errors and error constants	T1			
		2.5	effects of proportional (P)	T1			
		2.6	proportional integral (PI)	T1, T2			
		2.7	proportional derivative (PD)	T1, T2			
		2.8	proportional integral derivative (PID) systems.	T1			
		2.9	The concept of stability – Routh's stability criterion	T1			
		2.10	limitations of Routh's stability,	T1			
		2.11	root locus concept – construction of root loci (simple problems)	T1			
		2.12	Effect of addition of Poles and Zeros to the transfer function.	T1, T2			
	UNIT III - Frequency Response Analysis						
3	CO3: To understand basic aspects of design and compensation of LTI systems using Bode diagrams.	3.1	Introduction to frequency domain specifications	T1, T2	14	Chalk & Talk, PPT, Smart board'Lab, Tutorial	
		3.2	Bode diagrams	T1, T2			
		3.3	transfer function from the Bode diagram	T2			
		3.4	Polar plots, Nyquist stability criterion	T1, T2			
		3.5	stability analysis using Bode plots (phase margin and gain margin).	T2			
	UNIT IV- Classical Control Design Techniques						
	CO4: To learn Frequency Response approaches for the analysis of LTI systems using Bode plots, polar plots and Nyquist stability criterion.	4.2	physical realisation	T1	10		
		4.3	design of compensators using Bode plots.	T2			
		4.4	lead compensators	T1			
		4.5	lag-lead compensators	T1, T2			

UNIT V - State Space Analysis of Linear Time Invariant (LTI) Systems							
5	CO5: **:** To learn state space approach for analysis of LTI systems and understand the concepts of controllability and observability.	5.1	Concepts of state	T1, T2	**12**	Chalk & Talk, PPT Tutorial, Active Learning & Seminars	
		5.2	state variables and state model	T1, T2			
		5.3	State space representation of transfer function	T2			
		5.4	diagonalization using linear transformation	T2			
		5.5	solving the time invariant state equations	T1, T2			
		5.6	State Transition Matrix and its properties	T1, T2			
		5.7	concepts of controllability and observability.	T2			
		TOTAL			**63**		

CO1	Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.	APPLY	K3
CO2	Determine time response specifications of second order systems and absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.	APPLY	K3
CO3	Analyze the stability of LTI systems using frequency response methods.	APPLY	K3
CO4	Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode diagrams.	ANALYZE	K4
CO5	Represent physical systems as state models and determine the response. Understand the concepts of controllability and observability.	APPLY	K3

CO-PO MAPPING: **(**1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]]; '-': No Correlation**)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1-K3	3	3	3	3	2	2	2		3	2	3	3
CO2-K3	3	3	3	2	2	2	2		3	2	3	3
CO3-K3	3	3	3	3	2	2	2		3	2	3	2
CO4-K4	3	3	3	3	2	2	2		2	2	2	3
CO5-K3	3	3	3	2	2	2	2		3	2	3	2

S.NO	GRADUATE ATTRIBUTION	ACTION VERBS	LEVEL
1	ENGINEERING KNOWLEDGE	APPLY	K3
2	PROBLEM ANALYSIS	ANALYZE	K4
3	DESIGN DEVELOPMENT OF SOLUTIONS	UNDERSTANDIG	K2

4	INVESTIGATION OF COMPLEX PROBLEMS	APPLY, ANALYZE,	K3,K4
5	MODERN TOOL USAGE	APPLY	K3
6	ENGINEER AND SOCIETY	ANALYZE	K4
7	ENVIRONMENT AND SUSTAINABILITY		
8	ETHICS		
9	INDIVIDUALS AND TEAM WORK	APPLY, ANALYZE	K3,K4
10	COMMUNICATION	APPLY, ANALYZE,	K3,K4
11	PROJECT MANAGEMENT AND FINANCE	APPLY	K3
12	LIFE LONG LEARNING		

Text Books:	
S.No.	**AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION**
1.	Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India
2.	Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2 nd Edition
Reference Books:	
S.No.	**AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION**
1.	Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4 th Edition.
2.	Control Systems Engineering by Norman S. Nise, Wiley Publications, 7 th edition
3.	Control Systems by Manik Dhanesh N, Cengage publications.
4.	Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5 th Edition.

		Name	Signature with Date
i.	Faculty	B.Ganesh	
ii.	Course Coordinator		

HOD **PRINCIPAL**