COURSE CODE: **1152EE124**	COURSE TITLE: **DIGITAL CONTROL SYSTEMS**	L	T	P	C
		3	**0**	**0**	**3**

COURSE CATEGORY:

Program Elective

PREAMBLE :

This course will supplement the Control System course in Program Core by introducing the concepts of digital control system, design of compensators in discrete domain, formulating state model for discrete time system and finally providing idea about optimal control.

PREREQUISITE COURSES:

- Control Systems

COURSE EDUCATIONAL OBJECTIVES:

The objectives of the course are to make the students,

- Introduce about digital control system
- Design compensators in discrete domain
- Extend the knowledge of state space to discrete time system
- Provide the basics of Optimal control and Lyapunov stability

COURSE OUTCOMES :

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

CO No	Course Outcome	Knowledge Level(Revised Blooms Taxonomy)
CO1	Understand the method conversion of continuous time to discrete time systems and the need of digital control system	K2
CO2	Apply the knowledge of Z-transforms in handling difference equations and obtaining the pulse transfer functions	K2
CO3	Design compensators via time and frequency domain methods	K2
CO4	Develop state model and check for controllability and observability of discrete time system perform a design via pole placement	K2
CO5	Understand the application of Lyapunov theorems and about optimal control	K2

CORRELATION OF COs AND POs

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

COURSE CONTENT:		
UNIT I	**INTRODUCTION**	**9**
Need for digital Control-Signal Conversion-Distcrete Time Signals- Discrete Time system Representation- Quantizing and Quantization Error- Sampling Process-Sampling Rate selection-Aliasing-Data Reconstruction		
UNIT II	**PULSE TRANSFER FUNCTIONS**	**9**
Z- Transform-Inverse Z Transform- Difference Equation-Mapping s-Plane to z- Plane-Pulse Transfer Function- Pulse Transfer Function of Closed Loop System- Stability- Jury's Stability Test- Bilinear transformation		
UNIT III	**DESIGN OF SAMPLED DATA SYSTEM**	**9**
Root locus Method – Controller Design using root locus-Nyquist Stability Criteria-Bode Plot – Lag/Lead and Lag-Lead Compensator design in frequency domain- Design of Systems with Dead Beat- Some Practical Issues		
UNIT IV	**STATE SPACE MODEL FOR DISCRETE TIME SYSTEMS**	**9**
Introduction- State Variable representation-Conversion from state model to transfer function and vice versa- Solution of state difference equation- Concepts of Controllability and Observability- Design Via Pole Placement- State Observers		
UNIT V	**LYAPUNOV STABILITY AND OPTIMAL CONTROL**	**9**
Stability Definition-Lyapunov Stability Theorem- Lyapunov functions for linear/nonlinear system-Introduction to Optimal Control- Performance Indices- LQR design		
		TOTAL: 45 PERIODS
		TEXT BOOKS:
1. "Discrete Time Control Systems" by Kautshiko Ogata, Pearson Education ,2nd edition 2015 2. "Digital Control and State Variable Methods" by M.Gopal, TMH Publication , 2nd edition, 2014		
REFERENCE BOOKS:		
1. "Digital Control System" by B.C Kuo,Oxford University Press, 2nd Edition, 2007 2. "Digital Control of Dynamic Systems", by G. F. Franklin, J. D. Powell and M. L. Workman,Addison Wesley, 3rd edition 2010		