DIGITAL CONTROL SYSTEMS

Course Code	20EE4702C	Year	IV	Semester(s)	I
Course Category	Professional Elective-IV	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Signals and Systems & Control Systems
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Understand** the fundamentals of digital control systems, sampling theorem (L2)
CO2	**Apply** the basic knowledge of Z-transforms and assess the state of the digital control systems (L3)
CO3	**Apply** various stability tools to check the performance and design of state feedback control systems (L3)
CO4	**Analyze** various state space modeling techniques in digital control systems (L4)
CO5	**Examine** the stability of discrete-time control systems and state feedback controllers via pole placement in z-plane (L4)
CO6	**Ability** to do various problems in Digital control systems and submit a report.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3												2	1
CO3	3		3	2									2	1
CO4		3											2	1
CO5		3		2									2	1
CO6									3	2		3	2	1

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Discrete Representation of Continuous Systems:** Basics of Digital Control Systems, Discrete representation of continuous systems, advantages and disadvantages, examples, Impulse sampling and data hold – transfer function of Zero order hold, sampling theorem	CO1, CO2 CO6

II	**The Z-transform:** Z transforms of some elementary functions, important **theorems** of the Z-transform, inverse Z-transform using partial fraction expansion method (simple poles and atleast one zero case), z-transform method for solving difference equations, the pulse transfer function.	CO1, CO2 CO4 & CO6
III	**State space analysis:** Concept of the state space method, State space representations of discrete time systems, solving discrete time state space equations-Homogeneous case (z-transform approach), Controllability, Observability (Kalman's Test), principle of duality	CO1, CO2 CO4 &CO6
IV	**Stability analysis**: Mapping between the s-plane and the z-plane-primary, complementary strips and constant attenuation lines mapping, Stability Analysis of closed loop systems in the Z-plane, the Jury stability test, Stability analysis using bilinear transformation,	CO1, CO3, CO5& CO6
V	**State Feedback Controllers & Observers:** Design via pole placement, necessary and sufficient condition (Ackerman's formula), State observers – necessary and sufficient condition for state observation, full order state observer (Ackerman's formula)	CO1, CO3, CO5& CO6

Learning Resources
Text Books
1. K.OGATA ,Discrete-time Control Systems, prentice hall international, 2nd edition, 2015. 2. B.C.KUO , Digital Control Systems, Oxford University Press, 2nd edition, 2007.
Reference Books
1. M.Gopal ,Digital Control Engineering, New Age International, 2nd edition,2014. 2. V.L.GEORGE, C.P.KURIAN, Digital Control systems, Cengage Learning, 2nd edition,1998.
Web Links 1. https://nptel.ac.in/courses/108103008