DIGITAL CONTROL SYSTEMS

Course Code	19EE4702C	**Year**	IV	**Semester**	I
Course Category	Program Elective-V	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	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	**Explain and classify** discrete representation of LTI systems. L2
CO2	**Evaluate** knowledge on Z-Transforms in discrete time analysis. L5
CO3	**Examine** the conventional and state space methods for discrete systems L4
CO4	**Analyze** the stability criterion for digital systems and methods L4
CO5	**Develop** and design digital compensators explicitly compared to continuous time compensators. L3

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

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

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction and signal processing:** Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Continuous and Discrete Time Signals – Sample and hold devices – Sampling theorem and data reconstruction(A/D&D/A) – Frequency domain characteristics of zero order hold.	CO1
II	**z–transformations:** z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.	CO2
III	**State space analysis and the concepts of Controllability and observability:** State space representation of discrete time systems – Solving Discrete Time state space equations – State transition matrix and its properties – Discretization of continuous time state equations – Concepts of controllability and observability – Kalman Test(without proof). **State Feedback Controllers and State Observers**	CO3

	Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula – Design of state observers (Full Order).	
IV	**Stability analysis:** Mapping between the s–Plane and the z–Plane – Primary strips and Complementary strips – Stability criterion – Modified Routh's stability criterion (bilinear transformation) and Jury's stability test.	CO4
V	**Design of discrete–time control systems by conventional methods:** Transient and steady state specifications – Design using frequency response in the w–plane for lag and lead compensators	CO5

Learning Resources
Text Books
1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition. 2. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
Reference Books
1. Digital Control and State Variable Methods by M.Gopal, TMH, 4th Edition