Course code	Course name	L-T-P-Credits	Year of Introduction
AE407	DIGITAL CONTROL SYSTEM	3-0-0-3	2016

Prerequisite : AE301 Control system

Course objectives

- To study the stability analysis of digital control system
- To equip the basic knowledge of digital process control design

Syllabus

Discrete Data Control Systems - Signal conversion & processing - Z-transform- inverse Z-transform - Digital control systems- Pulse transfer function - Stability tests Frequency domain analysis of discrete systems - State space representation - Controllability and Observability -

Expected outcome

- At the end of the semester Students will have knowledge of digital process control design.

Text Books

1. B. C. Kuo , "*Digital control systems*" (Second Edition) , Oxford University Press, 2007
2. K. Ogatta, "*Discrete Time control systems* ", 2nd ed. (PHI),1995
3. M. Gopal, "*Digital Control systems and state variable methods*", Tata McGraw Hill.

Reference

1. John Dorsey , "*Continuous & Discrete Control Systems* ", (MGH).
2. Nagrath & Gopal , "*Control System Engineering*" (Wiley Eastern).

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Introduction: Basic Elements of discrete data control systems, advantages of discrete data control systems, examples. Signal conversion & processing: Digital signals & coding, data conversion & quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold and polygonal hold.	6	15%
II	Review of Z transform. z transform and inverse z transform . Relationship between s- plane and z- plane- Difference equation . Solution by recursion and z-transform.	6	15%
	FIRST INTERNAL EXAMINATION		
III	Digital control systems- Pulse transfer function . z transform analysis of closed loop open loop systems- Modified z- transfer function- Stability of linear digital control systems	8	20%
IV	Stability tests- Steady state error analysis- Root loci - Frequency domain analysis- Bode plots- Gain margin and	8	20%

	phase margin		
SECOND INTERNAL EXAMINATION			
V	Review of state space techniques to continuous data systems, state space representation of discrete time systems- Transfer function from state space model-various canonical forms- conversion of transfer function model to state space model-characteristics equation- solution to discrete state equations.	7	15%
VI	Controllability and Observability - Response between sampling instants using state variable approach-Pole placement using state feedback . Dynamic output feedback- Effects of finite wordlength on controllability and closed loop pole placement-	7	15%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)