M.TECH SECOND SEMESTER

EEPC2T5A **DIGITAL CONTROL SYSTEMS (ELECTIVE-III)** **Credits: 4**

Lecture: 4 periods/week **Internal assessment: 30 marks**

Semester end examination: 70 marks

Objective :

This subject deals with digital control systems and their advantages and disadvantages, sampling theorem. Z-transforms of digital control system. Mapping between S-plane and Z-plane, stability analysis. State space analysis of the system and microprocessor and DSP control of digital control system.

Learning outcomes:

After completing this course, student will able to

1. Understand the concept of sampling theorem and the z-transform of digital control systems
2. They knows the concept of mapping between s-plane and z-plane with stability analysis.
3. Analyze the importance of state space analysis of the system
4. They learn the importance of microprocessor and DSP control of digital control systems.

Unit 1: Discrete data and digital Control Systems – basic elements, advantages and disadvantages, examples, - Impulse sampling and data hold – transfer functions of Zero order hold and First order hold. Reconstructing original signals from sampled signals – sampling theorem, ideal low pass filter, frequency response characteristics of the Zero order hold.

Unit 2 : The Z-transform, Z transforms of some elementary functions, Important properties and theorems of the Z-transform, The inverse Z-transform, S-transform method for solving difference equations, the pulse transfer function, realization of digital controllers.

Unit 3: Mapping between the s-plane and the z-plane, the Jury stability test, stability analysis by use of the bilinear transformation and Routh stability criterion. Liapunov stability analysis of discrete time systems.

Unit 4: Transient response specifications, steady state error analysis. Design based on frequency response method, Analytical design method.

Unit 5: Concept of the state space method, State space representations of discrete time systems, solving discrete time state space equations. Discretisation of continuous time state space equations.

Unit 6: Controllability, Observability, Principle of Duality, Design via pole placement necessary and sufficient condition. Ackerman's formula, Dead Beat response.

Unit 7: State observers – necessary and sufficient condition for state observation, full order state observer, minimum order state observer.

Unit 8: Microprocessor and DSP control : Microprocessor control of control systems, single-board controllers with custom-designed chips, DMC – 105 board, digital signal processors – TMS 320 DSPs, development system and support tools. Effects of finite word length and quantization on controllability and closed loop pole placement. Effect of quantization – least upper bound on quantization error.

Reference Books :

1. Discrete-time Control Systems, 2nd edition K.OGATA, Pearson Education Asia.
2. Digital Control Systems : 2nd edition, B.C.KUO, Oxford University Press