

IV B.Tech II Semester Supplementary Examinations, July/August - 2017

DIGITAL CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B**Answer ALL sub questions from Part-A**Answer any THREE questions from Part-B*

PART-A (22 Marks)

1. a) Explain the zero order hold device. [3]
- b) What are the limitations of z-transform method? [4]
- c) Explain the concept of state transition matrix? [3]
- d) What are the conclusions from the general mapping between the s and z planes by the z transform? [4]
- e) What are the steady state specifications? Explain in brief. [4]
- f) State the necessary condition for design of state feedback controller through pole placement? [4]

PART-B (3x16 = 48 Marks)

2. a) Explain the following examples of digital control system [8]
(i) A step motor control system (ii) Microprocessor controlled system
- b) List out the advantages of digital systems? [5]
- c) State the sampling theorem? [3]
3. a) The input-output of a sampled data system is described by the difference equation $y(k+2) + 3y(k+1) + 4y(k) = r(k+1) - r(k)$ Determine the pulse transfer function. [8]
- b) Find the inverse z-transform function of $\frac{z-0.4}{z^2+z+2}$ [8]

4. Define controllability and observability of discrete time systems. For the following system,

$$\frac{Y(z)}{U(z)} = \frac{z^{-1}(1 + 0.8z^{-1})}{1 + 1.3z^{-1} + 0.4z^{-2}}$$

Determine whether the system is observable and controllable.

[16]

5. Check if all the roots of the following characteristic equations lie within the unit circle

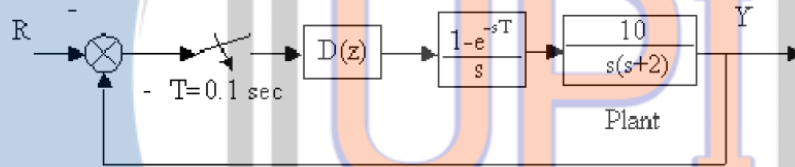
(i) $5z^2 - 2z + 2 = 0$

(ii) $z^3 - 0.2z^2 - 0.25z + 0.05 = 0$

(iii) $z^4 - 1.7z^3 + 1.04z^2 - 0.268z + 0.024 = 0$

[16]

6. A block diagram of a digital control system is shown in Figure 1. Design a compensator $D(z)$ to meet the following specifications:
- Velocity error constant, $K_v \geq 4 \text{ Sec.}$,
 - Phase margin $\geq 40^\circ$ and
 - Band width = 1.5 rad./sec.



[16]

Figure.1

7. a) Derive the necessary condition for the digital control system
 $X(k+1) = AX(k) + Bu(k)$
 $Y(k) = CX(k)$ to be Controllable. [10]
- b) Derive the sufficient conditions for design of state feedback controller through pole placement? [8]

UPIQP.BANK.COM