PVP 12

Code: EE8T4C

IV B.Tech - II Semester – Regular Examinations – April 2016

DIGITAL CONTROL SYSTEMS
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1. a) Explain clearly the configuration of basic digital control scheme with the help of neat block diagram. 8 M

   b) Explain 6 M

   i) Successive approximation ADC

   ii) Tracking ADC

2. a) Find the Z-transforms of the following

   (i) $f(t) = e^{-at} \sin \omega t$ (ii) $F(s) = \dfrac{1}{s^2(s+1)}$ 7 M

   b) Find the inverse Z-transforms of the following 7 M

   (i) $F(z) = \dfrac{z-4}{(z-1)^2(z-2)}$ (ii) $F(z) = \dfrac{z^2}{(z-1)(z-0.2)}$

3. a) Solve the following differential equation 7 M

   $y(k+2) + 3y(k+1) + 2y(k) = 0,\ y(-1) = -1/2, y(-2) = 3/4$

b) Obtain the pulse transfer function of closed loop system in the following cases. 7 M

i) Error sampling ii) Input sampling

4. Determine the solution of state equation for discrete time system by using 14 M

a) Recursion procedure b) Z –transform method

5. a) Derive the condition for complete state controllability. 4 M

b) Examine whether the discrete data system 10 M

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -2 & -2 \end{bmatrix} x(k) + \begin{bmatrix} 1 \\ -1 \end{bmatrix} u(k),$$

$$y(k) = [1 \quad 0]\, x(k)$$

Is i) State controllable ii) Output controllable and iii) Observable.

6. a) Explain the mapping between s-plane and z-plane. 5 M

b) Consider the discrete time unity-feedback control system, whose open loop pulse transfer function is given by $G(z) = \frac{K(0.3679Z + 0.2642)}{(Z - 0.3679)(Z - 1)}$. Determine the range of gain K for stability by use of the Jury's stability test. 9 M

7. a) Discuss the design procedure of lead- lag compensation in frequency domain. 7 M

b) Explain the design procedure of digital controller through bilinear transformation. 7 M

8. a) Define the following terms 6 M

i) Full order state observer

ii) Minimum order state observer

iii) Reduced order observer.

b) Consider the system described by $x(k+1)= Gx(k) + Hu(k)$

Where $G=\begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}$, $H=\begin{bmatrix} 1 \\ 0 \end{bmatrix}$ Determine a suitable state feedback gain matrix K such that the system will have the close loop poles at $z = 0.5+j.05$ and $z = 0.5-j.05$. 8 M