Total No. of Questions : 12]

SEAT No. :

P3353

[Total No. of Pages : 4

[4959]-86
B.E. (Electrical)
DIGITAL CONTROL SYSTEMS
(2008 Pattern) (Semester - II) (Elective - IV)

Time : 3 Hours] ***[Max. Marks : 100***

Instructions to the candidates:

1) ***Answer any one Question from each pair of Questions Q1 & Q 2, Q 3 & Q 4, Q 5 & Q 6, Q 7 & Q 8, Q 9 & Q 10, Q 11 & Q 12.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Explain various types of Analog to Digital & Digital to Analog converters. **[8]**

b) State with proper reason, whether the following systems are **[8]**

i) Static or Dynamic

ii) Linear or Non linear

iii) Shift invariant or variant

iv) Causal or Noncausal

:→ (1) $Y(n) = x(-n+2)$ (2) $Y(n) = x(2n)$

OR

Q2) a) Compare Digital control system with Analog control system. **[8]**

b) What are different sampling methods? Give importance of Shanon's sampling Theorem. **[8]**

P.T.O.

Q3) a) Derive Z-transform of: **[8]**

i) Unit Impulse ii) Delayed unit impulse

iii) Unit ramp iv) Delayed unit ramp

b) What is relation between pulse transfer function and state model of discrete time system? Derive it. **[8]**

OR

Q4) a) Explain various methods to obtain Inverse Z–transform: **[8]**

b) Find inverse - Z transform of following: **[8]**

i) $X(z)=\frac{1}{(z-1)(z-3)}$

ii) $\frac{X(z)}{z}=\frac{5}{6z^2-z-1}$

Q5) a) Explain with proper diagrams mapping between s-plane and z-plane. **[9]**

b) The characteristic equation of system is

$$F(z)=z^4-0.6z^3-0.81z^2+0.67z-0.12=0$$

Describe its stability by Jury's Test. **[9]**

OR

Q6) a) What do you mean by stability analysis using bilinear Transformation? Explain it with Routh's stability criterion. **[9]**

b) For the following system, determine what should be the range of gain K using Jury's stability test: $z^3+(3k)z^2+(k+2)z+4=0$ **[9]**

SECTION - II

Q7) a) What are different methods to determine state transition matrix (STM) for state difference equation x (k+1) = G *x* (k) + H u (k)? Explain them. **[8]**

b) Determine a suitable gain matrix k for the following system such that it will have close loop poles at z =0.5 ± j 0.5 $G = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}$; $H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ **[8]**

OR

Q8) a) With proper diagrams, explain direct, cascade & parallel decompositions of Discrete time Pulse Transfer Function. (P.T.F.) **[8]**

b) Obtain STM of $x(k+1) = Gx(k) + Hu(k)$; where **[8]**

$$G = \begin{bmatrix} 0 & 1 \\ -0.2 & -1 \end{bmatrix}; \quad H = \begin{bmatrix} 1 \\ 1 \end{bmatrix}.$$

Q9) a) Define the concepts 'Controllability' & 'Observability' of discrete time system. Also explain their tests. **[8]**

b) Investigate controllability & observability of system: **[8]**

$$x(k+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -0.01 & 0.21 & 0.8 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(k)$$

$$y(k) = \begin{bmatrix} 0 & 0 & 1 \end{bmatrix} x(k) + 0$$

OR

Q10)a) With proper block diagram explain Full order observer. What are its types? **[8]**

b) Design a full order state observer for the system having desired eigen values at $z = -1.8 + j2.4$ & $-1.8 - j2.4$ for **[8]**

$$G = \begin{bmatrix} 0 & 20.6 \\ 1 & 0 \end{bmatrix}; \quad H = \begin{bmatrix} 1 \\ 0 \end{bmatrix}; \quad C = \begin{bmatrix} 0 & 1 \end{bmatrix}$$

Q11)a) Draw proper block diagram of Digital temperature control system & explain function of each block. **[8]**

b) Determine state space representation in controllable canonical form for the system $\frac{Y(z)}{U(z)} = \frac{4z^2 - 3z + 0.5}{z^3 + z^2 - z - 0.75}$ **[10]**

OR

Q12)a) Explain digital position control system with proper block diagram. **[8]**

b) Write short note on : Transformation of state space model to controllable & observable canonical form. **[10]**

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