

Total No. of Questions : 8]

SEAT No. :

P3986

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[Total No. of Pages : 3

B.E. (Electrical)

c - DIGITAL CONTROL SYSTEMS

(Semester - II) (2012 Course) (Elective - III) (End-Sem.)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Figures to the right side indicate full marks.

Q1) a) Check whether the following systems are **[8]**

- i) Static or Dynamic
- ii) Linear or non-Linear
- iii) Time invariant or Time variant

1) $Y(n) = \text{Cos}[x(n)]$

2) $Y(n) = x(2n)$

b) Examine the stability of the following characteristic equation by Jury's test.

$P(Z) = Z^4 - 0.6Z^3 - 0.81Z^2 + 0.67Z - 0.12 = 0.$ **[8]**

c) Derive the solution of a non-Homogeneous state equation of a discrete time system from first Principles. **[4]**

OR

Q2) a) For a given sequence : $x(n) = \{4, 3, 0, 1, 2\}$ **[4]**

↑

- i) Delay the sequence by 3 samples.
- ii) Fold & advance the sequence by 2 samples.
- iii) Downscale the sequence by time 2 samples.
- iv) Up-scale the sequence by amplitude scales.

P.T.O.

- b) Describe design procedure of digital lead compensator using bode plot for discrete time system. [8]
- c) Discuss the various methods used for computation of state transition matrix (STM) $\Phi(k)$ From the given state difference equation $x(k+1) = Gx(k) + Hu(k)$. [8]

Q3) a) Given

$$x(k+1) = \begin{pmatrix} 1 & 1 \\ -2 & -1 \end{pmatrix} x(k) + \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} u(k) \quad \& \quad y(k) = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} x(k) \quad [10]$$

Determine controllability & observability of the system.

- b) What is principle of duality? Explain the effect of pole-zero cancellation on controllability & Observability. [6]

OR

Q4) a) For the system having

$$G = \begin{pmatrix} 0 & 1 \\ -0.16 & -1 \end{pmatrix}; \quad H = \begin{pmatrix} 1 \\ 0 \end{pmatrix}; \quad C = (0 \quad 1)$$

Determine a suitable gain matrix K such that the system will have Eigen values at $Z = 0.5 + j0.5$, $Z = 0.5 - j0.5$. [10]

- b) Explain full order Observer with proper block diagram. [6]

Q5) a) Consider the system defined by

$$\frac{Y(z)}{U(z)} = \frac{3z^2 - 11z}{z^3 - 6z^2 + 11z - 6}$$

Determine State space representation in Controllable canonical form & Observable canonical form. [10]

b) Consider the pulse transfer function of discrete time system given as

$$\frac{Y(z)}{U(z)} = \frac{b_0 z^n + b_1 z^{n-1} + b_2 z^{n-2} + \dots + b_n}{z^n + a_1 z^{n-1} + a_2 z^{n-2} + \dots + a_n}$$

Derive its Jordan canonical form. [6]

OR

Q6) a) Consider the pulse transfer function of discrete time system given as

$$\frac{Y(z)}{U(z)} = \frac{b_0 z^n + b_1 z^{n-1} + b_2 z^{n-2} + \dots + b_n}{z^n + a_1 z^{n-1} + a_2 z^{n-2} + \dots + a_n}$$

Derive its Controllable canonical form & Observable canonical form. [10]

b) Explain Eulers forward & backward method with suitable example. [6]

Q7) a) Explain Hybrid system simulation with block diagram & their application. [10]

b) Explain Computer program structure for simulation of discrete time control system with algorithm & flow charts. [8]

OR

Q8) a) Draw a neat block diagram of digital position control scheme and Explain the function of each block. [10]

b) Explain Stepper motor control with proper block diagram. [8]

