Total No. of Questions : 8]

SEAT No. :

P3986

[Total No. of Pages : 3

[4959]-1076

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) $Y(n) = Cos[x(n)]$

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]**
$\uparrow$

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) Φ(k) From the given state difference equation x(k + 1) = Gx(k) + Hu(k). **[8]**

Q3) a) Given

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

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

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

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

Derive its Jordan canonical form. **[6]**

OR

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

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

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]**