

Total No. of Questions : 8]

SEAT No. :

**P568**

[Total No. of Pages : 2

[6004]-504

**B.E. (Electrical)**

**ADVANCED CONTROL SYSTEM  
(2019 Pattern) (Semester - VII) (403142)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

Q1) a)  $\frac{Y(s)}{U(s)} = \frac{S+1}{S^2+1.3S+0.4}$  Given system represent in [10]

- i) Controllable canonical form.
- ii) Observable canonical form.

b) For a given system  $A = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix}$ ,  $x(0) = [1 \ 0]^T$ .

Obtain STM & find its solution. [8]

OR

Q2) a) Explain and derive the Cayley Hamilton theorem of STM. [8]

b) Derive the transfer function from the state variable model and Evaluate

the transfer function  $\frac{Y(s)}{U(s)}$  from the state variable model of a discrete

time system with usual notation. [10]

$$X = \begin{bmatrix} 1.8 & 1 \\ 0 & 2.5 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0.5 \end{bmatrix} u$$

$$Y = [1 \ 0]x$$

P.T.O.

**Q3) a)** Given  $X = \begin{bmatrix} 0.1 & 0.1 & 0 \\ 0.3 & -0.1 & -0.2 \\ 0 & 0 & -0.3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} u$  &  $Y = [1 \ 0 \ 1]x$ .

Determine controllability & Observability of the system. [8]

b) Derive and explain Ackermann's formula for Pole placement design. [9]

OR

**Q4) a)** What is principle of duality? Explain the effect of pole-zero cancellation on controllability & Observability. [8]

b) For a given system  $A = \begin{bmatrix} 0 & 15 \\ 1 & 0 \end{bmatrix}$ ,  $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ ,  $C = [0 \ 2]$ .

Determine observing gain matrix  $K_e$  such that  $S_1, S_2 = -2 \pm j3$  are eigen values of observer gain matrix. [9]

**Q5) a)** Explain in detail basic building blocks of discrete time control system. [8]

b) Explain the sampling & reconstruction process, State the sampling theorem and Give its importance. [9]

OR

**Q6) a)** Show how mapping of left half of S-plane is done into the Z plane with stable and unstable Region. [8]

b) Determine stability of system using Jury's Test whose characteristic polynomial is  $2z^4 + 8z^3 + 12z^2 + 5z + 1 = 0$ . [9]

**Q7) a)** Define adaptive control. Explain the need of adaptive control. What is adaption mechanism? [6]

b) Explain Gain scheduling adaptive control strategy with proper block diagram. [6]

c) Draw block diagram of Model Reference Adaptive Control scheme and explain it. [6]

OR

**Q8) a)** Describe a self-tuning regulator with suitable block-diagram. [6]

b) List out the properties of sliding mode control. [6]

c) Explain the terms, variable structure control, sliding mode control, sliding phase, reaching phase and chattering with suitable diagram. [6]

