Total No. of Questions : 8]

SEAT No. :

PB-2267

[Total No. of Pages : 2

[6263]-105
B.E.(Electrical Engineering)
ADVANCED CONTROL SYSTEM
(2019 Pattern) (Semester - VII) (403142)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to teh right side indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) State and prove the properties of state transition matrix (STM). **[4]**

b) Define state, state vector, state equation and output Equation. Draw state diagram. **[6]**

c) For a given system **[8]**

$$A=\begin{pmatrix} 0 & 1 \\ -2 & -3 \end{pmatrix} \quad x(0)=\begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

OR

Q2) a) Write down the steps to be followed for computing state transition matrix using Caley Hamilton theorem. **[4]**

b) Evaluate the transfer function Y(s)/U(s) from the state variable model of a system with usual notation. **[6]**

$$x=\begin{pmatrix} -2 & -3 \\ 4 & 2 \end{pmatrix}x+\begin{pmatrix} 3 \\ 5 \end{pmatrix}u, \quad y=\begin{pmatrix} 1 & 1 \end{pmatrix}x$$

c) Obtain diagonal canonical state model of state Space representation of the system. Also draw state model diagram. **[8]**

$$\frac{C(s)}{R(s)}=\frac{s+5}{s^3+6s^2+11s+6}$$

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Q3) a) What is principle of Duality? Explain effect of pole-zero cancellation on Controllability and Observability. **[7]**

b) Given **[10]**

$$\dot{x} = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{pmatrix} x + \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} u$$

$$y = \begin{pmatrix} 1 & 3 & 2 \end{pmatrix} x$$

Determine Controllability& Observability of the system.

OR

Q4) a) Derive and explain Ackermann's formula for pole placement design. **[7]**

b) For a given system **[10]**

$$A = \begin{pmatrix} 0 & 1 \\ 0 & -2 \end{pmatrix} \quad B = \begin{pmatrix} 0 \\ 4 \end{pmatrix} \quad C = \begin{pmatrix} 1 & 0 \end{pmatrix}$$

Determine the observer gain matrix K_e such that the observer poles are placed at $S_1, S_2 = -8, -8$.

Q5) a) Explain mapping between s-plane and z-plane with proper diagrams. **[8]**

b) Determine stability of system using Jury's test whose characteristic polynomial is $P(z) = Z^3 + 2.1Z^2 + 1.44Z + 0.32 = 0$. **[10]**

OR

Q6) a) Explain the sampling and reconstruction process. Also state the sampling theorem and give its importance. **[8]**

b) Explain in detail the basic building blocks of discrete time control System with appropriate diagram. **[10]**

Q7) a) What is adaptive control? **[3]**

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

c) What is reaching law? Why is it required? Derive expressions of control for constant rate reaching law, constant plus proportional rate reaching law and power rate reaching law. **[8]**

OR

Q8) a) Explain the terms sliding phase and reaching phase in the context of sliding mode control. **[3]**

b) Explain the gain scheduling adaptive scheme with a block diagram. **[6]**

c) Draw block diagram of Model Reference Adaptive Control scheme and explain it. **[8]**

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