Total No. of Questions : 8]

SEAT No. :

P3308

[Total No. of Pages : 3

[5670]-577
B.E. (Electrical)
CONTROL SYSTEM - II
(2015 Course) (Semester - I) (403145)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) *Answer any one question from each pair of questions: Q.1 & Q.2, Q.3 & Q.4, Q.5 & Q.6 Q.7 & Q.8*
2) *Figures to the right side indicate full marks.*

Q1) a) What are the practical aspects of choice of sampling rate? **[6]**

b) Obtain the Z-transform of the function **[6]**

$$F(z) = \frac{Z+1}{Z^2+0.3Z+0.02}$$

c) Explain with proper diagram, correspondence between the primary strip in the S -plane and the unit circle in Z-plane. **[8]**

OR

Q2) a) Explain concept of sampling and reconstruction process. **[6]**

b) State Initial value theorem. Find initial value of **[6]**

$$X(z) = \frac{Z^2}{6Z^2-4Z-1}$$

c) Explain the concept of stability analysis of closed loop system using Jury's stability test and Bilinear test. **[8]**

Q3) a) Derive an expression for state model of armature control DC motor. **[6]**

b) Obtain the state model for a system describe by the differential equation **[6]**

$$\frac{d^3y(t)}{dt^3}+5\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}+2y(t)=2u(t)$$

c) Explain how to obtain state model by direct decomposition of transfer function. **[6]**

OR

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Q4) a) Explain the procedure to obtain state model of system using parallel programming **[6]**

b) Obtain transfer function from given state model **[6]**

$$X^{o}(t)=\begin{bmatrix}-2 & -3\\ 4 & 2\end{bmatrix}X+\begin{bmatrix}3\\ 5\end{bmatrix}u(t). \text{ and } Y=\begin{bmatrix}1 & 1\end{bmatrix}X$$

c) Define the terms related to state space: State, state vector, state equation and output equation. **[6]**

Q5) a) Describe the evaluation of state transition matrix by Laplace transform method and infinite series method. **[6]**

b) Diagonalization the matrix **[10]**

$$A=\begin{bmatrix}0 & 1 & 0\\ 3 & 0 & 2\\ -12 & -7 & -6\end{bmatrix}$$

OR

Q6) a) Obtain the solution of Non-homogeneous state equation. **[6]**

b) Determine the state transition matrix for the system **[10]**

$$X^{o}(t)=\begin{bmatrix}-2 & 3\\ 0 & -3\end{bmatrix}X(t)$$

Q7) a) Explain methods of testing controllability of control system. **[6]**

b) Design state feedback gain matrix K for the given system such that desired closed loop poles are at -2, -1+j2 and -1-j2 **[10]**

$$A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -2 & -3\end{bmatrix};\quad B=\begin{bmatrix}0\\ 0\\ 1\end{bmatrix};C=\begin{bmatrix}1 & 0 & 0\end{bmatrix}$$

OR

Q8) a) Describe any two methods of evaluating state feedback gain matrix. **[6]**

b) Evaluate controllability and observability of the given system. **[10]**

$$\begin{bmatrix} X1^{o} \\ X2^{o} \\ X3^{o} \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -9 & -11 & -6 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

$$Y(t) = \begin{bmatrix} -10 & -10 & -5 \end{bmatrix} x(t)$$

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