1. A second order system with an initial condition of $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$ without any external input. The state transition matrix for the system is given by $\begin{bmatrix} e^{-2t} 0 \\ 0 e^{-t} \end{bmatrix}$. The state of the system at the end of 1 second is given by

(a) $\begin{bmatrix} 0.271 \\ 1.100 \end{bmatrix}$ (b) $\begin{bmatrix} 0.135 \\ 0.368 \end{bmatrix}$ (c) $\begin{bmatrix} 0.271 \\ 0.736 \end{bmatrix}$ (d) $\begin{bmatrix} 0.135 \\ 1.100 \end{bmatrix}$

2. The following equation defines a separately excited dc motor in the form of differential equation

$$\frac{d^2\omega}{dt^2} + \frac{B}{J}\frac{d\omega}{dt} + \frac{K^2}{LJ}\omega = \frac{K}{LJ}V_a$$

The above equation may be recognized n the state-space form as follows

$$\begin{bmatrix} \frac{d^2\omega}{dt^2} \\ \frac{d\omega}{dt} \end{bmatrix} = P\begin{bmatrix} \frac{d\omega}{dt} \\ \omega \end{bmatrix} + QV_a$$

Where the P matrix is given by

(a) $\begin{bmatrix} -\frac{B}{J} & -\frac{K^2}{LJ} \\ 1 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} -\frac{K^2}{LJ} & -\frac{B}{J} \\ 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & 1 \\ -\frac{K^2}{LJ} & -\frac{B}{J} \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 0 \\ -\frac{B}{J} & -\frac{K^2}{LJ} \end{bmatrix}$

3. The state variable description of a linear autonomous system is, X=AX, where X is two dimensional state vector and A is the system matrix given by A = $\begin{bmatrix} 0 & 2 \\ 2 & 0 \end{bmatrix}$. The roots of the characteristic equation are

(a) -2 and +2 (b)–j2 and +j2 (c)-2 and -2 (d)+2 and +2

Statement for linked answer question 4 & 5

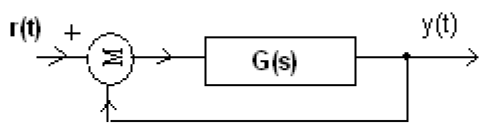
The state space equation of a system is described by x= Ax + Bu, Y = Cx

Where x is state vector, u is output and A = $\begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix}$, B = $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$, C= $\begin{bmatrix} 1 & 0 \end{bmatrix}$

4. The transfer function G(s) of this system will be

(a) $\frac{s}{s(s+2)}$ (b) $\frac{s+1}{s(s-2)}$ (c) $\frac{s}{(s-2)}$ (d) $\frac{1}{s(s+2)}$

5. A unity feedback is provided to the above system G(s) to make it closed loop system as shown in the figure.



For a unit step input r(t), the steady state error in the input will be

(a) 0 (b) 1 (c) 2 (d) ∞

6. A linear time invariant system is described by the following dynamic quation

dx(t)/dt= Ax(t) + Bu(t) y (t)= Cx(t)

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

the system is

(a) Both controllable and observable (b)Controllable but unobservable (c)Observable but uncontrollable

(d) Both uncontrollable and uncontrollable

7. Let X= $\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ x + $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$ U

U= $\begin{bmatrix} b, 0 \end{bmatrix}$

Where b is unknown constant

This system is

(a) Observable for all values of b (b)unobservable for all values of b (c)observable for all non-zero values of b (d)unobservable for all non-zero values of b

8. the state-space representation in phase-variable form for the transfer function

G(s) = $\frac{2s+1}{s^2+7s+9}$ is

(a) $\begin{bmatrix} 0 & 1 \\ -9 & -7 \end{bmatrix}x + \begin{bmatrix} 0 \\ 1 \end{bmatrix}u$; y = $\begin{bmatrix} 1 & 2 \end{bmatrix}x$ (b) $\begin{bmatrix} 1 & 0 \\ -9 & -7 \end{bmatrix}x + \begin{bmatrix} 0 \\ 1 \end{bmatrix}u$; y = $\begin{bmatrix} 0 & 1 \end{bmatrix}x$

(c)X= $\begin{bmatrix} -9 & 0 \\ 0 & -7 \end{bmatrix}x + \begin{bmatrix} 0 \\ 1 \end{bmatrix}u$; y = $\begin{bmatrix} 2 & 0 \end{bmatrix}x$ (d)X = $\begin{bmatrix} 9 & -7 \\ 1 & 0 \end{bmatrix}x + \begin{bmatrix} 0 \\ 1 \end{bmatrix}u$; y= $\begin{bmatrix} 1 & 2 \end{bmatrix}x$

9. Consider the single input, single output system with its state variablerepresentation :

$$\begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix}x + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}U$$

Y = $\begin{bmatrix} 1 & 0 & 2 \end{bmatrix}x$

The system is

(a) Neither controllable nor observable (b)Controllable but not observable (c)Uncontrollable but observable (d)Both controllable and observable

10. A particular control system is described by the following state equations :

$\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U$ and $Y = \begin{bmatrix} 2 & 0 \end{bmatrix} X$.

The transfer function of this system is :

(a) $\dfrac{Y(s)}{U(s)} = \dfrac{1}{2s^2 + 3s + 1}$ (b) $\dfrac{Y(s)}{U(s)} = \dfrac{2}{2s^2 + 3s + 1}$ (c) $\dfrac{Y(s)}{U(s)} = \dfrac{1}{s^2 + 3s + 2}$

(d) $\dfrac{Y(s)}{U(s)} = \dfrac{4}{2s^2 + 3s + 2}$