EE-792 Quiz-2 FALL-17

Last Name: ARORA First Name LAKSHAY

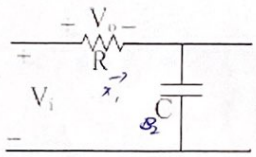
1. Write the state equation for the given circuit

   a. $\dot{X} = \frac{1}{RC}V_i - \frac{1}{RC}X$

   b. $\dot{X} = \frac{1}{R}V_i - \frac{1}{R}X$

   c. $V_0 = V_i - X_1$

   d. $\dot{X} = V_i - X$



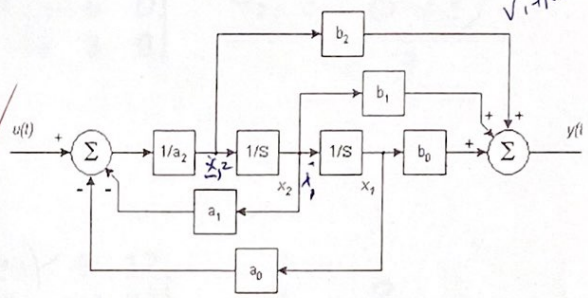
2. Write down the output equation for the given simulation diagram

   a. $\left[b_0 - \frac{b_2 a_0}{a_2}\right]X_1 + \left[b_1 - \frac{a_1 b_2}{a_2}\right]X_2 + \frac{b_2}{a_2}U$

   b. $\left[b_0 + \frac{b_2 a_0}{a_2}\right]X_1 + \left[b_1 + \frac{a_1 b_2}{a_2}\right]X_2 + \frac{b_2}{a_2}U$

   c. $\left[b_0 - \frac{b_2 a_0}{a_2}\right]X_1 - \left[b_1 - \frac{a_1 b_2}{a_2}\right]X_2 - \frac{b_2}{a_2}U$

   d. $\left[b_0 + \frac{b_2 a_0}{a_2}\right]X_1 - \left[b_1 + \frac{a_1 b_2}{a_2}\right]X_2 - \frac{b_2}{a_2}U$



3. Write the state equation (only $\dot{X}_2$) for given simulation diagram

   a. $\dot{X}_2 = [U + a_1X_2 + a_0X_1]$

   b. $\dot{X}_2 = [U - a_1X_2 - a_0X_1]$

   c. $\dot{X}_2 = [U + a_1X_2 + a_0X_1]\frac{1}{a_2}$

   d. $\dot{X}_2 = [U - a_1X_2 - a_0X_1]\frac{1}{a_2}$

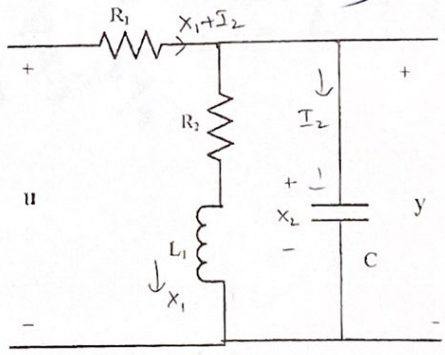
4. write the first loop equation for given circuit

   a. $U = R_1(X_1 + I_2) + R_2X_1 + L_1\dot{X}_1$

   b. $U = R_1(X_1) + R_2X_1 + L_1\dot{X}_1$

   c. $U = R_1(X_1) + R_2X_1 + \dot{X}_1$

   d. $U = R_1(X_1 + I_2) + X_1$



5. Write the output equation for the given circuit

   a. $y = X_2$

   b. $y = R_2X_1 + L_1\dot{X}_1$

   c. $y = R_2X_1 + L_1X_1$

   d. $y = R_2X_1 + L_1\dot{X}_1 + X_2$

Please show your work for partial credit.
Each question worth 2 points; this quiz worth 1 % of your final grade.

EE-792 Quiz-1 Fall-17

Last Name: ARORA First Name LAKSHAY

1. What is the determinant of the following matrix $A = \begin{bmatrix} 4 & 2 & 1 \\ 5 & 6 & 0 \\ 4 & 3 & 1 \end{bmatrix}$

   a. -9
   b. 9
   c. 5
   d. -15

$4(6-0)-2(5-0)+1(15-24)$
$24-10-9 = 24-19$

2. What is the cofactor of '5' the following matrix $A = \begin{bmatrix} 3 & 2 & 1 \\ 5 & 6 & 0 \\ 4 & 3 & 0 \end{bmatrix}$

   a. -3
   b. 3
   c. -15
   d. 15

$a_{21} = 0-(-3) = 3$

3. What is the rank of the following matrix $A = \begin{bmatrix} 3 & 6 & 9 & 12 \\ 8 & 16 & 24 & 32 \\ 4 & 8 & 12 & 16 \end{bmatrix}$

   a. 0
   b. 2
   c. 1
   d. 3

$R_2 \to R_2/2$

$A = \begin{bmatrix} 3 & 6 & 9 & 12 \\ 4 & 8 & 12 & 16 \\ 4 & 8 & 12 & 16 \end{bmatrix} \to R_2 \to R_2 - R_1$

$A = \begin{bmatrix} 3 & 6 & 9 & 12 \\ 0 & 0 & 0 & 0 \\ 4 & 8 & 12 & 16 \end{bmatrix}$

4. Find the inverse of A if $A = \begin{bmatrix} 2 & 0 \\ 4 & 1 \end{bmatrix}$

   a. $A^{-1} = \begin{bmatrix} 2 & 0 \\ 4 & 1 \end{bmatrix}$
   b. $A^{-1} = \begin{bmatrix} 0 & 2 \\ 1 & 4 \end{bmatrix}$
   c. $A^{-1} = \begin{bmatrix} 0.5 & 0 \\ -2 & 1 \end{bmatrix}$
   d. $A^{-1} = \begin{bmatrix} 1 & 0 \\ -4 & 2 \end{bmatrix}$

$A^{-1} = \frac{1}{\Delta} \text{adj} = \frac{1}{2-0} \begin{bmatrix} 1 & 0 \\ -4 & 2 \end{bmatrix}$

$R_1 \to R_1/3 \quad R_3 \to R_3/4$ =

5. Find matrix C if C=AB $A = [2 \quad 3]$ $B = \begin{bmatrix} 6 & 1 \\ 4 & 5 \end{bmatrix}$

   a. $C = \begin{bmatrix} 24 \\ 17 \end{bmatrix}$ b. $C = [24 \quad 17]$ c. $C = \begin{bmatrix} 18 & 3 \\ 8 & 15 \end{bmatrix}$ d. Operation not possible

$[2\ 3] \begin{bmatrix} 6 & 1 \\ 4 & 5 \end{bmatrix} \begin{matrix} 2 \\ 3 \end{matrix}$

$1\times2 \qquad 2\times2$

$[12+12 \quad 2+15]$

1×2

Please show your work for partial credit.
Each question worth 4 points; this quiz worth 1 % of your final grade.

EE-792 Quiz-3 FALL-17

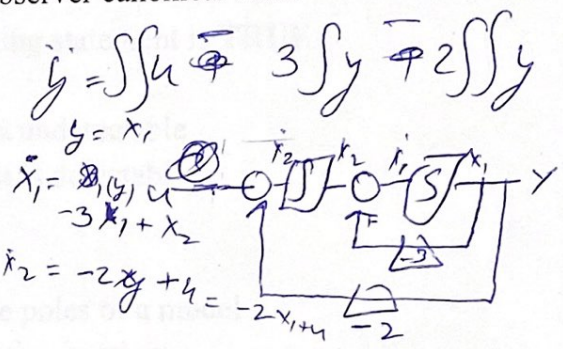
Last Name: ARORA 9/10 First Name LAKSHAY

1. In controllable canonical form which of the following statement is **TRUE**
   a. All state variables depends upon the input
   b. All state variables depends upon the output
   c. ✓ Only one state variable depends upon the input
   d. Only one state variable depends upon the output

2/2

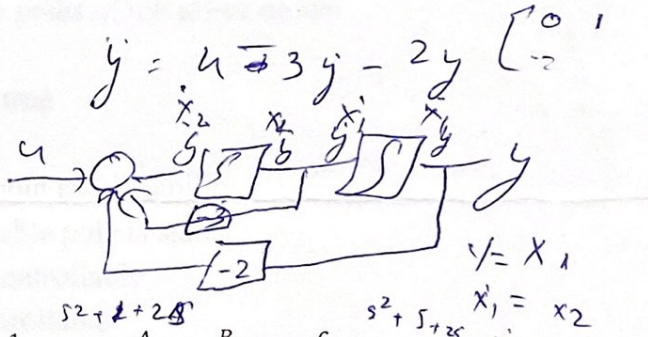
2. $\ddot{y} + 3\dot{y} + 2y = u$; write the state equation by using observer canonical form
   a. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$
   b. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-3 & -2\\ 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$
   c. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-3 & 1\\ -2 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}1\\ 0\end{bmatrix}u$
   d. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-3 & 1\\ -2 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$

2/2



3. $\ddot{y} + 3\dot{y} + 2y = u$; write the state equation by using controllable canonical form
   a. ✓ $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$
   b. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-3 & -2\\ 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$
   c. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-3 & 1\\ -2 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}1\\ 0\end{bmatrix}u$
   d. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-3 & 1\\ -2 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$

2/2



4. Find 'C' in the following function $F_{(s)} = \frac{1}{(s+2)(s+1)^2} = \frac{A}{S+2} + \frac{B}{S+1} + \frac{C}{(S+1)^2}$
   a. ✓ 1
   b. -1
   c. -2
   d. 2

2/2

$A(s^2 + 2s + 1) + B(s+2)(s+1) + C(s+2)$
$A s^2 + A + 2As + Bs^2 + 3Bs + 2B$
$A + B = 0 \Rightarrow A = -B$ $+ Cs + 2C$

5. In observable canonical form which of the following statement is **TRUE**
   a. All state variables depends upon the input
   b. ✓ All state variables depends upon the output
   c. Only one state variable depends upon the input
   d. Only one state variable depends upon the output

1/2

$2A + 3B + C$
$-2B + 3B + C = 0$
$A + 2B + 2C = 1$
$B = -C$
$+B + 2B - 2B = 1$

Please show your work for partial credit.
Each question worth 2 points; this quiz worth 1 % of your final grade.

EE-792 **Quiz-4** **FALL-17**

10/10

Last Name: ARORA **First Name** LAKSHAY

1. If the model is controllable then which of the following statement is **TRUE**
   - a. All poles can be changed anywhere a unique solution exists
   - b. All poles can be changed anywhere not unique solution exists
   - c. All poles can be changed anywhere a no solution exists
   - d. Poles are not interchangeable a unique solution exists

2 2

2. If the model is Observable then which of the following statement is **TRUE**
   - a. The model is undetectable
   - b. If unobservable poles are stable then it is undetectable
   - c. If unobservable poles are unstable then it is detectable
   - d. The model is detectable

2 2

3. Which of the following statement is **TRUE** about the poles of a model
   - a. The poles are the roots of the characteristic equation
   - b. Eigenvalues of 'A' matrix are the poles of the given model
   - c. Both statements are true
   - d. None of the above statements are true

2 2

4. Which of the following statement is **TRUE** about stabilizability
   - a. A model is stabilizable if controllable pole is stable
   - b. A model is stabilizable if it is uncontrollable
   - c. A model is stabilizable if it is controllable
   - d. A model is stabilizable if uncontrollable pole is stable

2 2

5. The denominator of the transfer function is called
   - a. Characteristic equation
   - b. Characteristic polynomial
   - c. Eigenvalues of the vectors
   - d. Poles of the given system

2 2

Please show your work for partial credit.
Each question worth 2 points; this quiz worth 1 % of your final grade.