

BANGLADESH UNIVERSITY OF BUSINESS AND TECHNOLOGY (BUBT)
Faculty of Engineering and Applied Sciences
Department of Electrical and Electronic Engineering
Program: B.Sc. in EEE
EEE 401: Control System Design
(Section: 1 & 2; Shift: Day; Intake: 26)

Class Test – 1

Fall 2021-22

Total Marks: 15

Time: 45 min.

Course Instructor: Sk. Hasibul Alam

Instructions:

- ‘M’ is the last digit of your student ID.
- Answer all questions.
- Keep your pages neat and clean. Insert page number for each page.
- The marks on the right-hand side in square brackets indicate marks for that question only.
- Upload your answer script in PDF format in Google Classroom.

CO1: Demonstrate the basic understanding of dynamic control systems [PO1]

1. Find the inverse Laplace transform of the following: [5]

$$G(s) = \frac{2 - 5s}{(s - M - 1)(s^2 + 11)}$$

2. Find the step response of the following system: [5]

$$G(s) = \frac{2s^2 - 9s}{(s + 4)(s + 6)(s + 8 + M)}$$

3. Find the transfer function $G(s) = V_L(s)/V(s)$ of the circuit shown in Fig. Q3 below: [5]

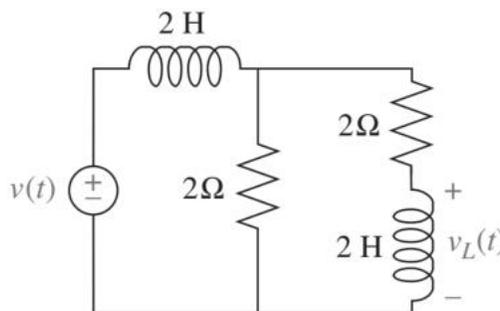


Fig. Q3

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Class Test – 1

Summer 2021

Total Marks: 15

Time: 1.5 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

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CO1: Demonstrate the basic understanding of dynamic control systems [PO1]

1. Find the inverse Laplace transform of the following, where ‘K’ is the last digit of your student ID. [5]

$$F(s) = \frac{13s + 8}{s^2 + 8s + (17 + K)}$$

2. Find the ramp response of a system with the following transfer function, where ‘K’ is the last digit of your student ID. [5]

$$G(s) = \frac{2s^2 - 5s^3}{(s + 4)(s^2 + 7 + K)}$$

3. Find the transfer function, $G(s) = V_o(s)/V_i(s)$ for the circuit in Fig. Q3 using mesh analysis. [5]
Here, each inductor has a value of 3 H, the capacitor has a value of 0.25 F, and the resistor has a value of $(K+1) \Omega$. Again, ‘K’ is the last digit of your student ID. Simplify your result.

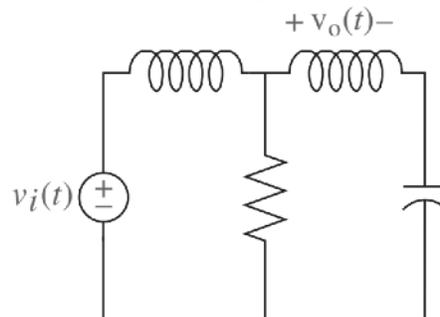


Fig. Q3

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Class Test – 2

Fall 2021-22

Total Marks: 15

Time: 25 min.

Course Instructor: Sk. Hasibul Alam

CO2: Develop the mathematical models of physical systems in forms suitable for use in the analysis and design of control systems [PO2]

Q1. Reduce the block diagram shown in Fig. Q1 to a single transfer function, $T(s) = C(s)/R(s)$. [5]

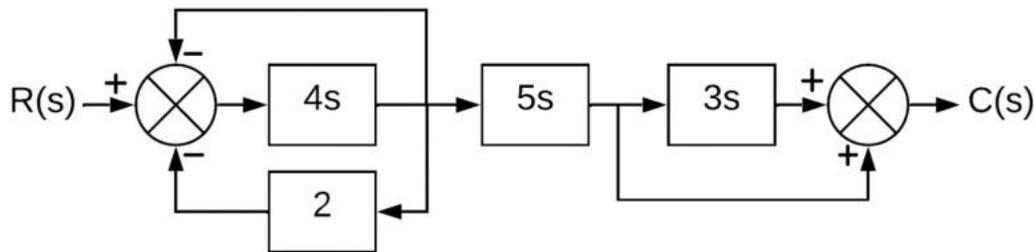


Fig. Q1

Q2. After converting the block diagram of Fig. Q2 to SFG, find the equivalent transfer function [10] using Mason's rule. You must simplify your answer.

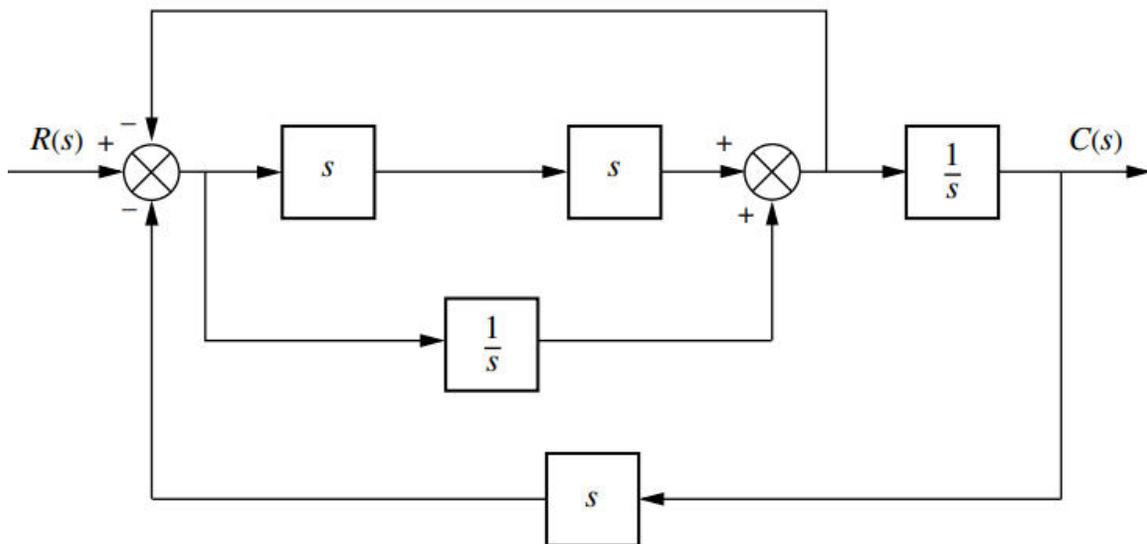


Fig. Q2

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Class Test – 2

Summer 2021

Total Marks: 15

Time: 1.5 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

- ‘M’ is the last digit of your Student ID.
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CO2: Develop the mathematical models of physical systems in forms suitable for use in the analysis and design of control systems. [PO1]

1. Determine the peak time and settling time for the following 2nd-order underdamped system: [5]

$$\frac{C(s)}{R(s)} = \frac{500 + M}{s^2 + 25s + 900}$$

2. Determine the overshoot and rise time for a 2nd-order underdamped system that has poles at location: $-9 \pm j17$. [5]

3. Determine the validity of 2nd-order approximation of the following: [5]

$$\frac{C(s)}{R(s)} = \frac{58}{(s + M + 4)(s^2 + 4s + 29)}$$

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Class Test – 3

Fall 2021-22

Total Marks: 15

Time: 45 min.

Course Instructor: Sk. Hasibul Alam

Instructions:

- ‘a’ & ‘b’ are the last two digits of your student ID, respectively.
- Answer all questions.
- Keep your pages neat and clean. Insert page number for each page.
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CO3: Analyze the time and frequency-domain responses of control systems to standard input signals [PO3]

Q1. Draw the SFG in phase-variable form for a system with the following state-space [10]
representation.

$$\dot{\mathbf{x}} = \begin{bmatrix} 1 & 5 \\ a & b \end{bmatrix} \mathbf{x} + \begin{bmatrix} 4 \\ 3 \end{bmatrix} r$$
$$y = [2 \quad 8] \mathbf{x}$$

Q2. Determine how many poles are on RHP, LHP, and $j\omega$ -axis for the following system. [5]

$$T(s) = \frac{C(s)}{R(s)} = \frac{9}{s^4 + 5s^3 + as^2 + bs + 9}$$

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Class Test – 3

Summer 2021

Total Marks: 15

Time: 1.5 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

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CO3: Analyze the time and frequency-domain responses of first and second-order systems to standard input signals; address the performance of control systems, and determine the stability of these system. [PO2]

1. Determine the equivalent transfer function $T(s) = C(s)/R(s)$ for the system shown in Fig. Q1 below. Assume, $G_1(s) = G_2(s) = s^2$ and $G_3(s) = H_1(s) = 1/s$. Simplify your result. [5]

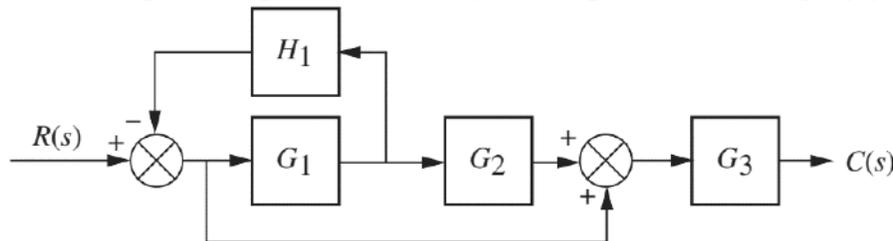


Fig. Q1

2. Using Mason's gain formula, determine the equivalent transfer function $T(s) = C(s)/R(s)$ for the system shown in Fig. Q2 below. Assume, $G_1(s) = G_2(s) = G_3(s) = G_4(s) = G_5(s) = G_6(s) = G_7(s) = s$ and $H_1(s) = H_2(s) = 1/s$. Simplify your result. [10]

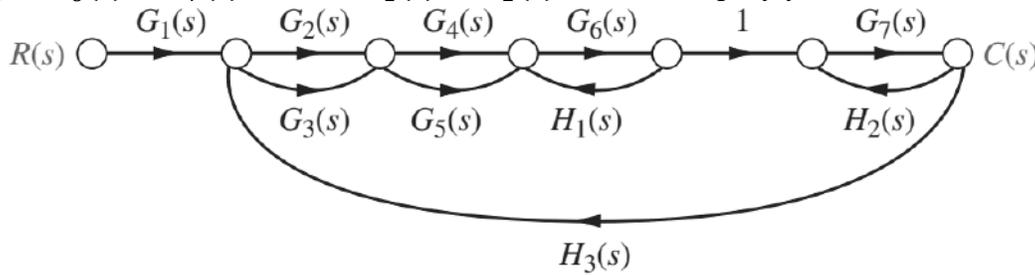


Fig. Q2