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 402: Control System Design Lab
(Section: 1; Shift: Day; Intake: 26)

Lab Final **Fall 2021-22** **Total Marks: 30** **Time: 25 min.**

Course Instructor: Sk. Hasibul Alam

Q1. Plot the step response & impulse response (5 seconds) of the following system. **[10]**

$$\frac{C(s)}{R(s)} = \frac{2s^2 + 64}{(s+2)(s+4)(s+8)}$$

Q2. Design a PD controller for a negative feedback system with the following specifications. Then plot its step response (5 seconds). **[10]**

$$K_P = 50, K_D = 25$$
$$Plant = \frac{4s}{s^2 + 8s + 9}$$
$$Feedback = \frac{2}{s^2 + 9s + 2}$$

Q3. Plot the root locus of a negative feedback system with the following specifications. **[10]**

$$G(s)H(s) = \frac{5s^2 + 9s}{s^6 + s^5 + 5s^3 + 4s^2}$$

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Lab Final **Summer 2021** **Total Marks: 30** **Time: 3 hrs.**

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Instructions:
- 'Z' is the last digit of your student ID.
- Answer all questions.
- The marks on the right-hand side in square brackets indicate marks for that question only.
- Attach your answer script in PDF format in Google Classroom. Use a cover page.
- Do not forget to rename your file as: **ID**.pdf
  (Example: 16173208999.pdf)
- Upload your answer script in portrait orientation.

1. Write a MATLAB code that will plot the impulse response of the following transfer function: **[5]**

$$G(s) = \frac{C(s)}{R(s)} = \frac{19s}{s^7 + (\mathrm{Z}+20)s^3 + (\mathrm{Z}+22)s^2 + 19}$$

2. Write a MATLAB code that will plot the step response of a system after adding an extra pole at $s = -(\mathrm{Z}+1)$ to the following transfer function: **[5]**

$$G(s) = \frac{15s}{s^6 + (\mathrm{Z}+10)s^4 + 15}$$

3. Write a MATLAB code that will plot the step response of a system after adding an extra zero at $s = -(\mathrm{Z}+1)$ to the following transfer function: **[5]**

$$G(s) = \frac{17s^2}{(s+2)(s^4 + (\mathrm{Z}+10)s^2 + 5)}$$

4. Write a MATLAB code that will show the closed-loop transfer function of a positive feedback system having the following transfer functions in the forward and feedback path, respectively: **[5]**

$$G(s) = \frac{20s^3 + 17}{s^4 + (\mathrm{Z}+10)s^2 + 20}$$

$$H(s) = \frac{20s^2 + 17}{s^3 + 10}$$

5. Write a MATLAB code that will plot the step response of a unity negative feedback system with a proportional-derivative controller. Assume, $K_P = 500$ and $K_D = 50$. The plant transfer function is: **[5]**

$$\frac{50s^2}{s^5 + s^4 + (Z + 10)s^2 + s + Z + 1000}$$

6. Write a MATLAB code that will find the state-space representation of the following transfer function: **[5]**

$$G(s) = \frac{C(s)}{R(s)} = \frac{19s^4 + 19s^3 + 19s^2 + Z + 19}{s^9 + (Z + 1)s^8 + (Z + 5)s^7 + 5s^3 + 17s^2 + 19}$$