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## Eighth Semester B.E. Degree Examination, July/August 2022 Control Engineering

Time: 3 hrs.

Max. Marks: 100

**Note:** Answer any FIVE full questions, selecting atleast TWO questions from each part.

### PART – A

- 1 a. What is closed loop control system? Using the schematic and block diagrams, explain closed loop system with an example. (10 Marks)  
 b. Explain : i) Proportional control and ii) Proportional and integral control actions. (10 Marks)
  
- 2 a. Find the transfer function of an armature controlled DC motor. (10 Marks)  
 b. A gas filled thermometer has a thermal resistance of 'B' and is filled with a gas whose thermal capacitance is 'C'. Obtain the transfer function relating the temperature of the gas inside thermometer to the temperature of the medium in which thermometer is inserted. Neglect the capillarity of the thermometer. (07 Marks)  
 c. Mention the electric analogy for the mechanical system. (03 Marks)
  
- 3 a. Using the block diagram reduction technique, find the closed loop transfer function of the system whose block diagram is shown in Fig Q3(a).

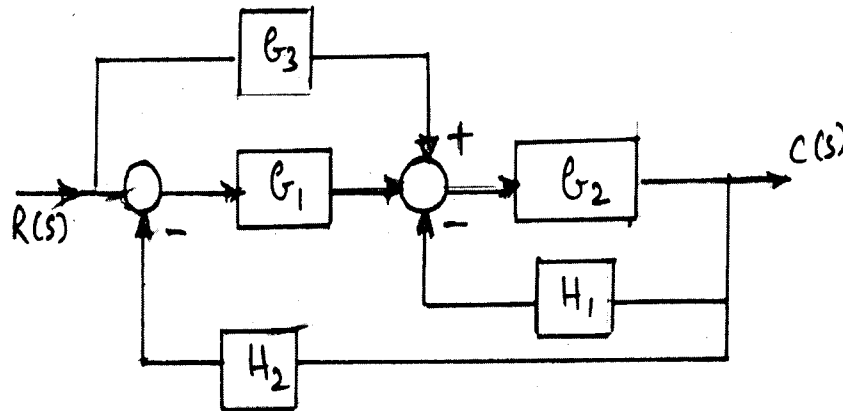


Fig Q3(a)

- b. For the system whose block diagram is shown in Fig Q3(a), draw the signal flow graph and find the transfer function using Mason's gain formula. (10 Marks)
  
- 4 a. What is time constant? Mention its significance. (03 Marks)  
 b. The first order control system is represented by a transfer function  $\frac{C(s)}{R(s)} = \frac{1}{s+5}$ . Determine the time constant and response for a unit step input. (07 Marks)  
 c. Define : i) Absolute stability ii) Relative stability. (04 Marks)  
 d. The open loop transfer function of the system is  $G(s)H(s) = \frac{K}{s(s+2)(s+10)}$ . Obtain the value of K for marginal stability using R-H criteria and frequency of oscillation at this value of K. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

## PART – B

- 5 a. Explain Nyquist stability criteria. (05 Marks)  
 b. Using Nyquist criteria determine the stability of the unity feedback system whose

$$G(s) = \frac{10(s+1)}{s(s-1)(s+5)}. \quad (15 \text{ Marks})$$

- 6 a. Define: i) Break frequency ii) Gain margin iii) Phase margin. (06 Marks)  
 b. A unity feedback system is characterized by the open loop transfer function  $G(s)H(s) = \frac{10(1+0.1s)}{s(1+0.5s)(s+4)}$ . Draw the BODE plots. Find the gain margin and phase margin. (14 Marks)

- 7 a. Define Zero's and poles. (02 Marks)  
 b. Sketch the root locus plot for the open loop transfer function

$$G(s)H(s) = \frac{K(s^2 + 6s + 25)}{s(s+1)(s+2)} \quad (18 \text{ Marks})$$

- 8 a. What is system compensation? Explain the types of compensation. (06 Marks)  
 b. What are the advantages of state space technique? (06 Marks)  
 c. Determine the observability using Gilbertz principle system whose state model is

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \text{ and } Y = [3 \ 4 \ 1] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}. \quad (08 \text{ Marks})$$

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