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18MA71

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Control Engineering

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define a control system. Explain open and closed loop control systems. **(10 Marks)**

b. With a block digram, explain
(i) PD controller
(ii) PID controller **(10 Marks)**

OR

2 a. Derive the transfer function of an armature controlled d.c. motor. **(12 Marks)**

b. Derive the transfer function of simple liquid level system. **(08 Marks)**

Module-2

3 a. Derive an expression for response of 1st order system for unit step input. **(10 Marks)**

b. A system has the following transfer function $\frac{C(s)}{R(s)} = \frac{20}{s+10}$. Determine its unit impulse and step response with zero initial condition. Sketch the response. **(10 Marks)**

OR

4 a. Define steady state error and derive an expression for steady state error. **(10 Marks)**

b. For a control system shown in Fig. Q4 (b), find the value of K_1 nd K_2 so that $M_P = 25\%$ and $T_P = 4$ sec. Assume unit step input. **(10 Marks)**

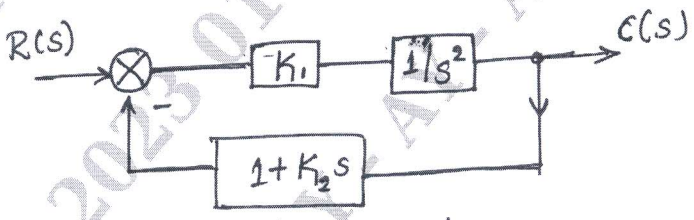

Fig. Q4 (b)

Module-3

5 a. Reduce the block diagram and obtain transfer function for the system shown in Fig. Q5 (a) **(10 Marks)**

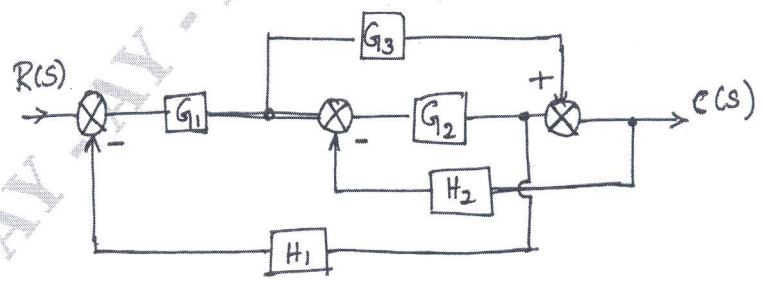

Fig. Q5 (a)

b. Obtain the Transfer function of the signal flow graph shown in Fig. Q5 (b), using Mason's gain. **(10 Marks)**

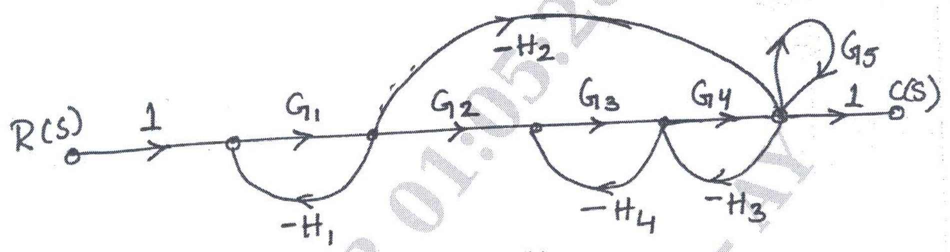

Fig. Q5 (b)

OR

6 a. Explain the elements of block diagram with a simple sketch. **(08 Marks)**

b. Construct the signal flow graph for the following set of system equations:

$$Y_2 = G_1Y_1 + G_3Y_3$$
$$Y_3 = G_4Y_1 + G_2Y_2 + G_5Y_3$$
$$Y_4 = G_6Y_2 + G_7Y_3$$

where Y_4 is output. Find transfer function $\frac{Y_4}{Y_1}$. **(12 Marks)**

Module-4

7 a. State and explain the Routh's stability criterion. **(08 Marks)**

b. For a system with characteristic equation,

$F(s) = s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$

Use Routh's criteria to determine the stability of a system. **(12 Marks)**

OR

8 Sketch the root locus for the OFB system whose open loop TF $G(s)H(s) = \frac{K}{s(s^2 + 6s + 10)}$. **(20 Marks)**

Module-5

9 Draw the Bode plot and determine GM.PM, Gain and Phase crossover frequencies for a unity feedback system having open loop TF. **(20 Marks)**

$$G(s) = \frac{10}{s(1 + 0.1s)(1 + 0.05s)}$$

OR

10 a. Sketch the polar plot for the transfer function : $G(s) = \frac{10}{s(s+1)(s+2)}$. **(10 Marks)**

b. Determine the stability of the system with $G(s)H(s) = \frac{(s+6)}{(s+2)(s-1)}$ using Nyquist stability criterion. **(10 Marks)**

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