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10AE71

Seventh Semester B.E. Degree Examination, July/August 2021
Control Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Explain Open loop and Closed loop system with a neat block diagram. Mention advantages and disadvantages of both. **(10 Marks)**

b. Explain different types of controllers used in the control systems. Mention the characteristics of each type. **(10 Marks)**

2 a. Determine the transfer function $\frac{Y_2(S)}{F(S)}$ of the system shown in Fig. Q2 (a). **(10 Marks)**

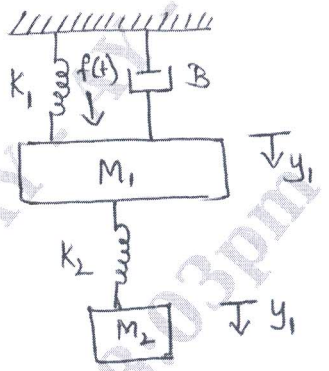

Fig. Q2 (a)

b. Explain the principle of AC servomotor in control systems and obtain the transfer function of it. **(10 Marks)**

3 a. Determine the transfer function $\frac{C(s)}{R(s)}$ using block diagram reduction technique for the closed loop system shown in Fig. Q3 (a). **(10 Marks)**

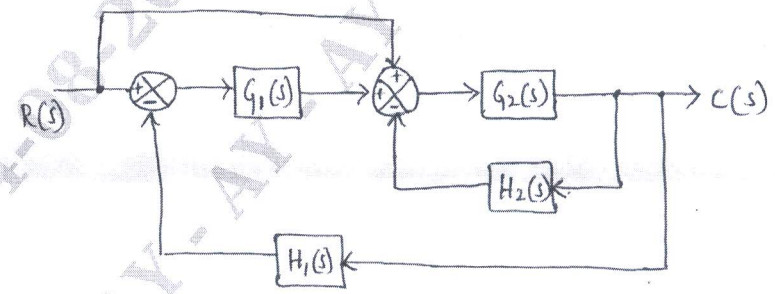

Fig. Q3 (a)

b. Determine the transfer function of the signal flow graph shown in Fig. Q3 (b). **(10 Marks)**

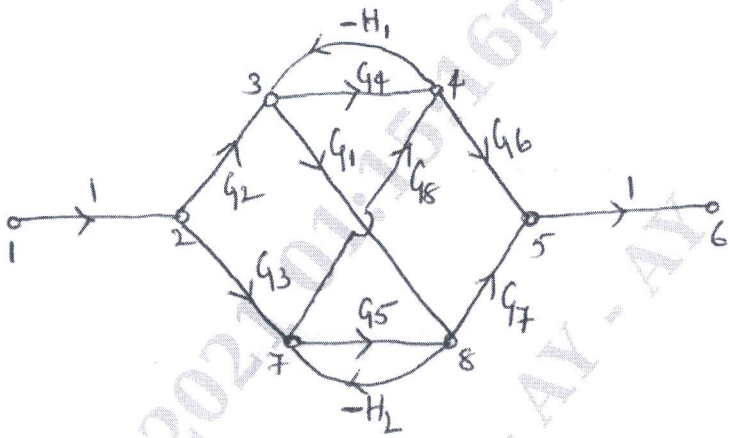

Fig. Q3 (b)

4 a. Measurements conducted on a servomechanism show that the system response to be $C(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$, when subjected to step input. Obtain the expression for closed loop transfer function. Determine the undamped natural frequency and damping ratio. **(10 Marks)**

b. Using Routh criterion, determine the stability of the system represented by the characteristic equation given by $s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$. Comment on the location of the roots of characteristic equation. **(10 Marks)**

5 a. The open loop transfer function of a unity feedback system is given by, $G(s) = \frac{1}{s(1+s)(1+2s)}$. Sketch the polar plot and determine the gain margin and phase margin. **(15 Marks)**

b. List out the advantages of frequency domain analysis. **(05 Marks)**

6 Sketch the bode plot for the following transfer function, $G(s) = \frac{75(1+0.2s)}{s(s^2+16s+100)}$. Obtain phase margin and gain margin. **(20 Marks)**

7 A unity feedback control system has an open loop transfer function, $G(s) = \frac{K}{s(s^2+4s+13)}$. Sketch the root locus. **(20 Marks)**

8 a. Briefly explain the concept of series and feedback compensation. **(08 Marks)**

b. Define controllability. Explain Gilbert's method and Kalman's method of testing controllability. **(12 Marks)**

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