CBCS SCHEME

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15AE71

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

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

1 a. Define control system. Distinguish between open loop and closed loop systems with an example each. **(08 Marks)**

b. List and explain briefly the requirements of an ideal control system. **(08 Marks)**

2 a. Obtain the transfer function of field controlled DC motor. **(08 Marks)**

b. Obtain differential equations for the mechanical system shown in Fig.Q2(b). Also draw equivalent force voltage and force current circuits using analogous quantities.

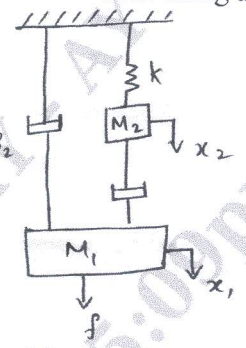

Fig.Q2(b) **(08 Marks)**

3 a. Obtain closed loop transfer function of the block diagram shown in Fig.Q3(a) using block diagram reduction techniques.

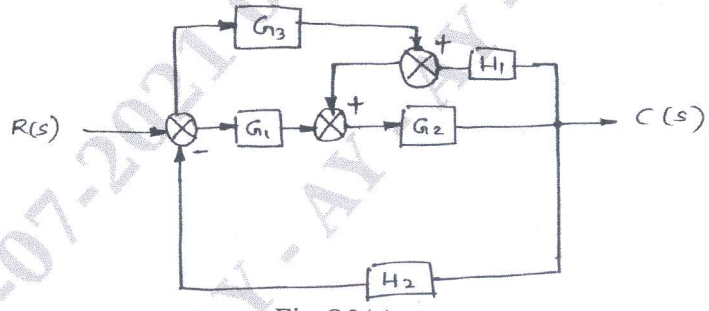

Fig.Q3(a) **(08 Marks)**

b. Find the transfer function for the signal flow graph shown in Fig.Q3(b) using Mason's gain formula.

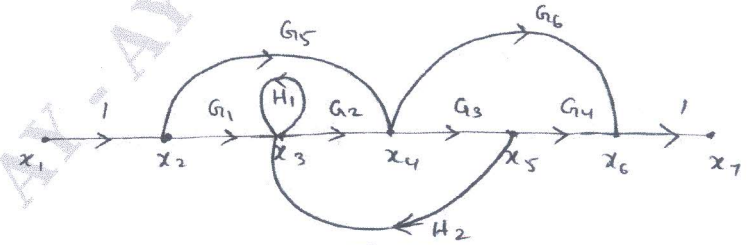

Fig.Q3(b) **(08 Marks)**

4 a. Obtain response equation for a first order mechanical system subjected to unit step input. **(08 Marks)**

b. A unit feedback control system is characterized by an open loop transfer function $G(s)H(s) = \frac{K}{s(s+10)}$. Determine the system gain K, so that the system will have damping ratio of 0.5. For this value of K, find rise time, peak time, setting time and peak over short. Assume the system is subjected to a step of IV. **(08 Marks)**

5 Sketch root locus for the given unit feedback transfer function $G(s) = \frac{K}{s(s+2)(s^2+8s+20)}$. **(16 Marks)**

6 Sketch the Bode plot for transfer function $\frac{G(s) = Ke^{-0.15}}{s(1+s)(1+0.15)}$. Find the 'K' for the cross over frequency = 5 rad/sec. **(16 Marks)**

7 a. Write a short note on frequency response. **(06 Marks)**

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

8 a. Explain the procedure to determine the relative stability of a system using polar plot with example. **(06 Marks)**

b. Using Nyquist criterion, investigate the stability of a system whose open loop transfer function is $G(s).H(s) = \frac{K}{(s+1)(s+2)(s+3)}$. **(10 Marks)**

9 a. Explain proportional controller and integral controller with block diagrams. **(08 Marks)**

b. Explain lead compensator with necessary circuit and equations. **(08 Marks)**

10 a. Define the terms: (i) State (ii) State variable (iii) State vector (iv) State space **(08 Marks)**

b. A system is represented by a differential equation $\dddot{y} + 6\ddot{y} + 12\dot{y} + 10y = 4u$, where y = output and u = input of system. Obtain state space equation. **(08 Marks)**

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