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10ME/PM82

Eighth Semester B.E. Degree Examination, June/July 2017

Control Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define control system. Compare open loop and closed loop control system will an example for each type. **(08 Marks)**

b. What are the ideal requirements of control system? **(06 Marks)**

c. Draw the block diagram of proportional plus integral plus derivative controller and state its characteristics. **(06 Marks)**

2 a. Write the differential equations governing the behaviour of the mechanical system shown in Fig.Q2(a). Also obtain the analogous electrical circuit based on force voltage analogy and loop equations.

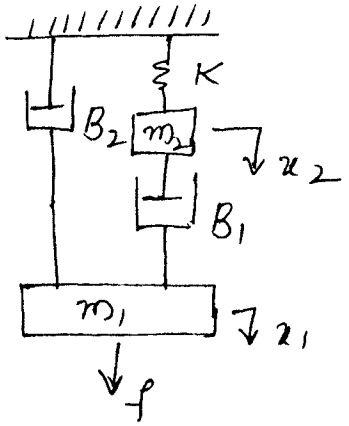

Fig.Q2(a) **(10 Marks)**

b. Obtain the transfer function of field controlled DC motor. **(10 Marks)**

3 a. Reduce the block diagram shown in Fig.Q3(a) and obtain the transfer function $\frac{C(s)}{R(s)}$.

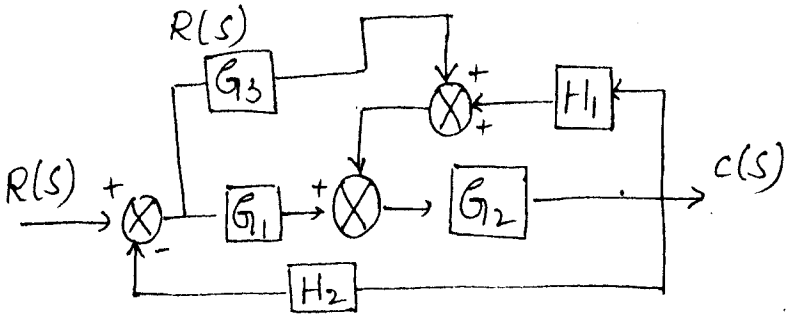

Fig.Q3(a) **(10 Marks)**

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

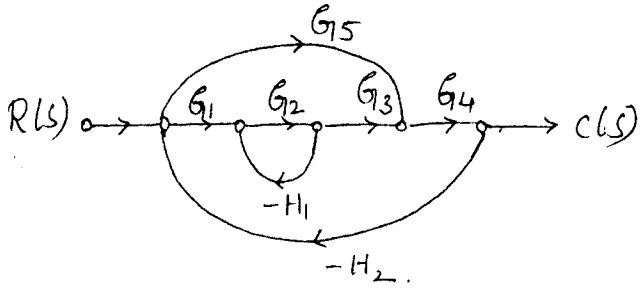

Fig.Q3(b) **(10 Marks)**

4 a. A units feedback system characterized by an open loop transfer function

$$G(s) = \frac{10}{s^2 + 2s + 6}$$

Determine the following, when the system is subjected to a unit step input:

i) Undamped natural frequently
ii) Damping ratio
iii) Peak overshoot
iv) Peak time
v) Settling time **(10 Marks)**

b. Explain Routh Hurwitz criterion for stability of a control system and examine the stability of $s^4 + 2s^3 + 3s^2 + 8s + 2 = 0$ using the same. **(10 Marks)**

PART – B

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

b. Plot the Nyquit diagram for the open loop transfer function

$$G(s)H(s) = \frac{12}{s(s+1)(s+2)}$$

and determine the nature of stability. **(10 Marks)**

6 Sketch the bode plot for a unity feed-back system, whose open loop transfer function is given by $G(s)H(s) = \frac{10}{s(1+s)(1+0.02s)}$, find:

i) Gain and phase cross over frequencies.
ii) Gain and phase margin.
iii) Stability of the closed loop system. **(20 Marks)**

7 Sketch the root locus plot for the system whose open loop transfer function is given by $G(s)H(s) = \frac{K}{s(s+2)(s^2+8s+20)}$. **(20 Marks)**

8 a. Explain the following:

i) Lead compensator
ii) Lag compensator **(10 Marks)**

b. Explain the series and feedback compensated system, with block diagrams. **(10 Marks)**

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