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10ME82

Eighth Semester B.E. Degree Examination, Feb./Mar. 2022
Control Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Distinguish between open loop and closed loop control system, with suitable examples. **(06 Marks)**

b. List and explain the ideal requirements of control system. **(04 Marks)**

c. What is control action? Briefly explain proportional, proportional plus integral and proportional plus integral plus derivative controllers, with the help of block diagrams. **(10 Marks)**

2 a. Find the transfer function for the mechanical system shown in Fig.Q2(a).

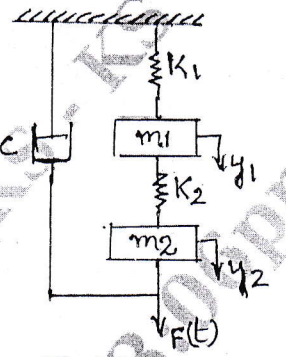

Fig.Q2(a) **(10 Marks)**

b. With the help of circuit diagram for armature controlled DC motor, obtain transfer function, which relates angular displacement, θ of motor shaft to the armature input voltage. **(10 Marks)**

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

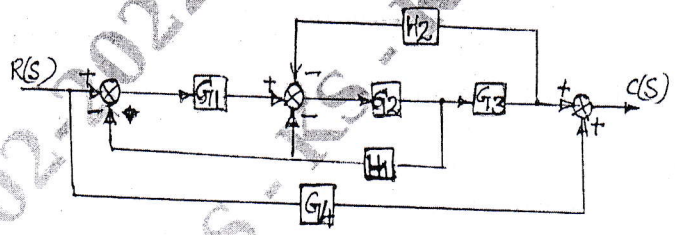

Fig.Q3(a) **(10 Marks)**

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

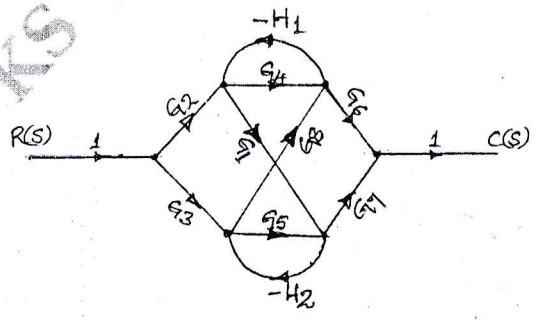

Fig.Q3(b) **(10 Marks)**

4 a. Derive expressions for the response of a first order system, subjected to:
(i) Step input (ii) Ramp input **(08 Marks)**

b. A system oscillates with a frequency ω, has poles at $S = \pm J\omega$ and no poles in the right half of S-plane. Determine the values of K and a, so that the system shown in Fig.Q4(b) oscillates at a frequency of 2 rad/sec.

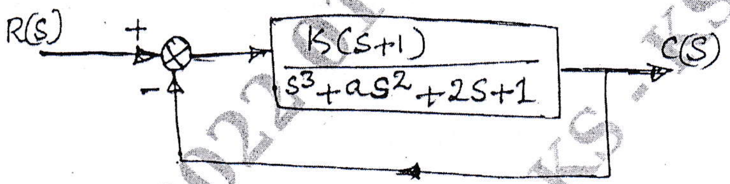

Fig.Q4(b) **(12 Marks)**

PART – B

5 a. State and explain the Nyquist stability criterion. **(06 Marks)**

b. Draw the Nyquist plot for a given open loop transfer function

$$G(s)H(s) = \frac{10}{s^3(1+s)}$$ **(14 Marks)**

6 Sketch the Bode plot and determine the gain and crossover frequencies and also find the stability of the system.

$$G(s) = \frac{10}{s(1+0.5s)(1+0.1s)}$$ **(20 Marks)**

7 Construct the root locus plot for the given system with open loop transfer function

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)(s+6)}$$

Also find the stability of the system. **(20 Marks)**

8 a. Explain the need for system compensation. **(04 Marks)**

b. Write notes on:
(i) Lead compensator
(ii) Lag compensator **(16 Marks)**

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