CBCS SCHEME

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15EE61

Sixth Semester B.E. Degree Examination, Feb./Mar. 2022
Control System

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define open loop and closed loop control system, mention any four differences between open loop and closed loop control system. **(08 Marks)**

b. For the mechanical system shown in Fig.Q.1(b). Draw the mechanical network and write the force voltage analogous electric network. **(08 Marks)**

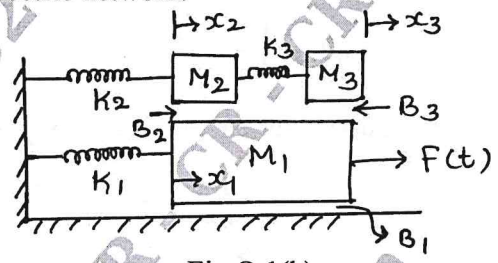

Fig.Q.1(b)

OR

2 a. Derive the transfer function of field control DC servomotor. **(08 Marks)**

b. Draw the Electrical networks based on torque current analogy give all the performance equation for the Fig.Q.2(b). **(08 Marks)**

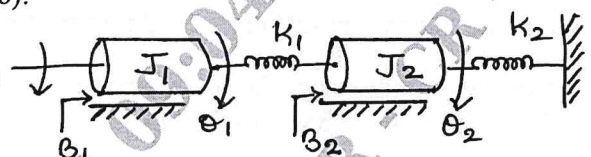

Fig.Q.2(b)

Module-2

3 a. Illustrate how to perform the following connection with block diagram reduction technique i) Blocks in parallel ii) Shifting summing point behind the block **(04 Marks)**

b. Find $\frac{C(S)}{R(S)}$ by Mason's gain formula. **(06 Marks)**

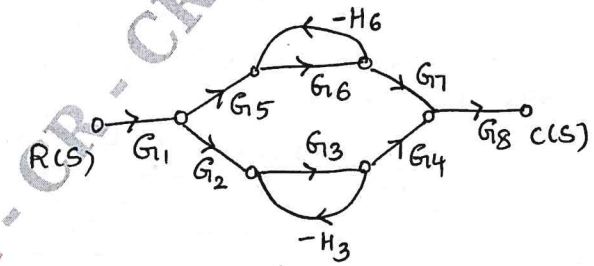

Fig.Q.3(a)

c. Obtain C(S)/R(S) using block diagram reduction rule. **(06 Marks)**

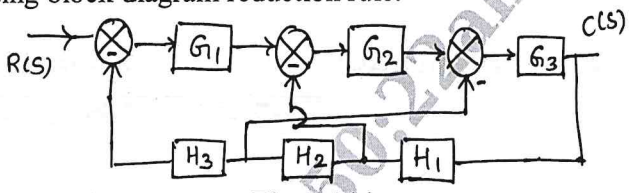

Fig.Q.3(c)

OR

4 a. Obtain the transfer function for the block diagram shown in Fig.Q.4(a). Using block diagram reduction technique. **(08 Marks)**

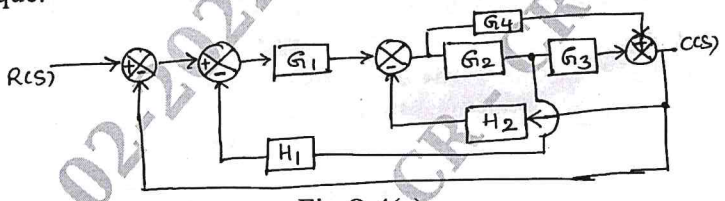

Fig.Q.4(a)

b. Find the transfer function for the given network. Using signal flow graph methods. **(08 Marks)**

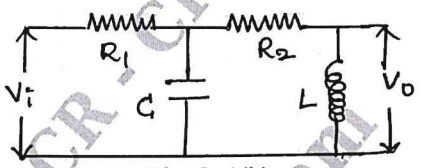

Fig.Q.4(b)

Module-3

5 a. Derive the time domain specification i) Peak time (T_p) ii) Rise time (T_r) **(06 Marks)**

b. What are necessary and sufficient condition for the system to be stable as for RH criteria? **(04 Marks)**

c. Comment on stability using Routh criteria of characteristic equation is $S^5 + 2S^4 + 3S^3 + 4S^2 + 5S + 6 = 0$. **(06 Marks)**

OR

6 a. A given system oscillate with frequency 2rad/sec, find the value of K_{mar} and 'P' number of pole are in RHS. **(08 Marks)**

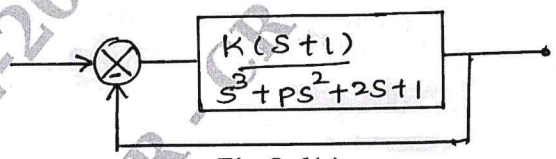

Fig.Q.6(a)

b. For the control system shown in Fig.Q.6(b), find the value of K_1 and K_2 so that $M_P = 25\%$ and $T_p = 4$sec. Assume unit step input. **(08 Marks)**

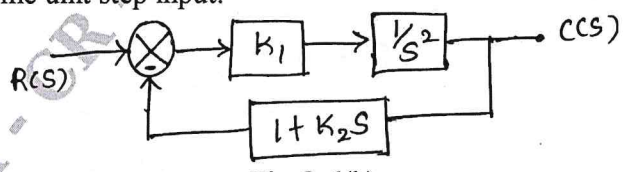

Fig.Q.6(b)

Module-4

7 a. The open loop transfer function of a control system is given by

$G(S) = \frac{K}{S(S+2)(S^2+6S+25)}$ Sketch the complete root locus as K varied from zero to infinity. **(12 Marks)**

b. Define the following with respect to frequency response specification:
   i) Resonant peak
   ii) Gain cross over frequency
   iii) Phase cross over frequency. **(04 Marks)**

OR

8 a. A unity feedback control system has $G(S) = \frac{80}{S(S+2)(S+20)}$. Draw the bode plot. Determine GM, PM, W_{gc} and W_{pc} comment on stability. **(12 Marks)**

b. For a single loop unity feedback system the open loop transfer function is given by $G(S) = \frac{K(S+2)(S+3)}{S(S+1)}$ show that the complex part of root locus is a circle identify its centre and radius. **(04 Marks)**

Module-5

9 a. Explain Nyquist stability criteria. **(06 Marks)**

b. Explain step by step procedure to design lag compensation network. **(10 Marks)**

OR

10 a. The open loop transfer function of unity negative feedback system is given by $G(S) = \frac{K(S+3)}{S(S^2+2S+2)}$ using the Nyquist criteria. Find the value of K for which the closed loop system is just stable. **(08 Marks)**

b. Explain the effect of PD and PI controller on the performance of second order system. **(05 Marks)**

c. Write a note on encirclement of a point. **(03 Marks)**

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