2054
B.E. (Electrical and Electronics Engineering)
Fourth Semester
EE-402: Control Engineering

Time allowed: 3 Hours   **Max. Marks: 50**

NOTE: *Attempt __five__ questions in all, including Question No. 1 (Part-A) which is compulsory and selecting two questions each from Part B-C.   Assume and specify any missing data.*

x-x-x

Part- A

I   a) Give basic equations and analogy of electrical and mechanical systems.   5x2
      b) Derive an expression for velocity and acceleration error constants.
      c) What is importance of checking location of closed loop poles on the imaginary axis of complex s-plane?
      d) Discuss the effects of feedback in control systems.
      e) What is electrical zero position of control transformer of synchros?

Part- B

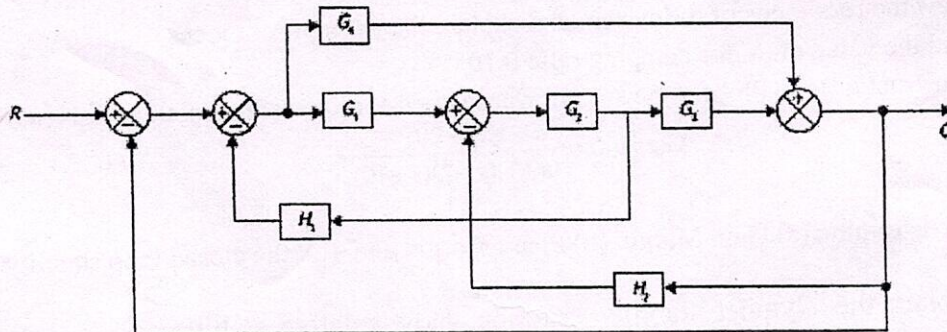II (a)   Find transfer function of the system shown in Figure 1 using Mason' gain formula.   (5)

Figure 1

    (b)   Discuss the effect of feedback on: (5)
               (i) Sensitivity to parameter variation.
               (ii) Control of effect of disturbance signals.

III (a)   Explain how a Thermal control system works. Illustrate. Give advantages and   (5)
           disadvantages of Thermal systems.

P.T.O.

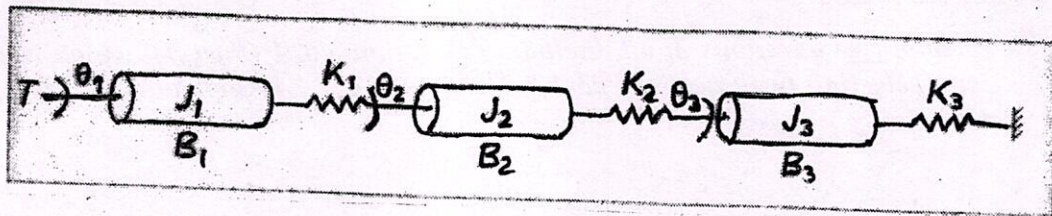(b) Obtain differential equations for the system shown in Fig 2 and draw the analogous electrical circuit. (5)

Fig 2

IV (a) What is steady state error? Derive expression for velocity error coefficient for Type 0,1 and 2 systems. (5)

(b) Using Routh-Hurwitz criterion, check the stability of the system with characteristics equation as: (5)

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$

Part- C

V The open loop transfer function of a unity feedback control system is G(s)=K/[s(s+4)(s+6)]. (10)

Draw the root locus of the system and explain the rules of root locus.
Find the value of K for damping ratio 0.10.

VI (a) Construct a Bode Plot for the system whose open-loop transfer function is given by: (5)

$$G(s)H(s) = \frac{K(s+20)}{(s+1)(s+2)(s+10)}$$

and determine (a) Gain Margin (b) Phase Margin and (c) the closed loop stability.

(b) Explain the Nyquist stability criterion. How relative stability can be checked using Nyquist criterion. (5)

VII(a) Explain the construction and working of Synchros as an error detector. (5)

(b) Explain the constant M and constant N circles and their usage in control system analysis. (5)

x-x-x