CBCS SCHEME

USN

18EC43

Fourth Semester B.E. Degree Examination, June/July 2024
Control Systems

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define closed loop control system. Compare open loop and closed loop control system. **(06 Marks)**

b. Write the differential equations of performance for the mechanical system in Fig.Q1(b). Draw its F – V analogous circuit.

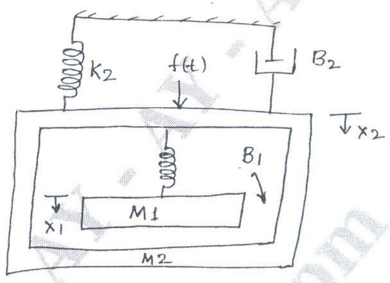

Fig.Q1(b) **(14 Marks)**

OR

2 a. What are the advantages of using negative feedback in control system? **(06 Marks)**

b. Draw the F – V and F – I analogues circuits for the mechanical system shown in Fig.Q2(b) with necessary equations.

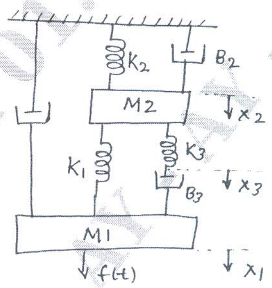

Fig.Q2(b) **(14 Marks)**

Module-2

3 a. State advantages and disadvantages of the block diagram reduction technique. **(06 Marks)**

b. For the block diagram shown in Fig.Q3(b), determine the transfer function : $\frac{Q_2(s)}{Q(s)}$ using block diagram reduction algebra.

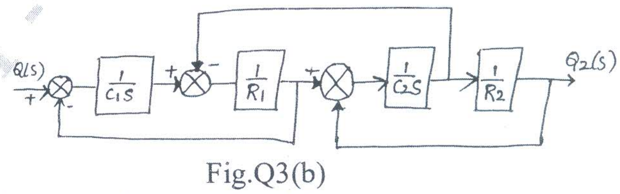

Fig.Q3(b) **(10 Marks)**

c. Derive the transfer function of simple closed loop system. **(04 Marks)**

OR

4 a. Find $\frac{C}{R}$ using Mason's gain formula for the signal flow graph shown in Fig.Q4(a).

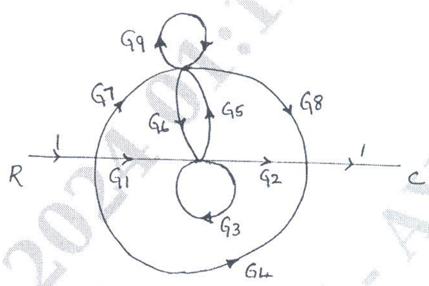

Fig.Q4(a) **(10 Marks)**

b. For the block diagram given in Fig.Q4(b) obtain overall transfer function using Mason's gain formula.

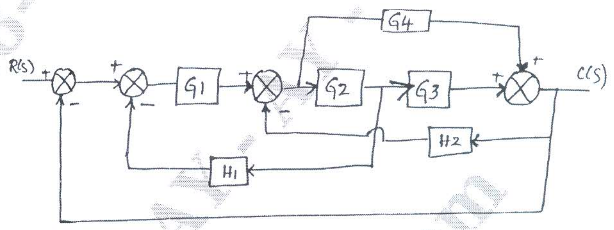

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. With the help of graphical representation and mathematical expressions, explain the following signals :
i) Step signal
ii) Ramp signal
iii) Impulse signal
iv) Parabolic signal. **(10 Marks)**

b. Derive an expression for the under-damped response of a second order feedback control system for step input. **(10 Marks)**

OR

6 a. For the system shown in the Fig.Q6(a)
i) Identify the type of $\frac{C(s)}{E(s)}$
ii) Find the values of kp, kv, ka
iii) If r(t) = 10u(t), find the steady state value of the output.

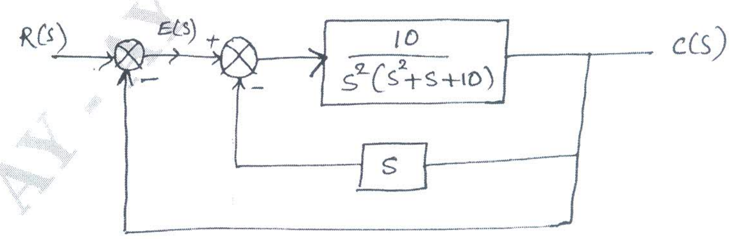

Fig.Q6(a) **(10 Marks)**

b. Discuss the various types of controllers used in the control systems. **(10 Marks)**

Module-4

7 a. $S^6 + 4s^5 + 3s^4 - 16s^2 - 64s - 48 = 0$. Find the number of roots of this equation with positive real part, zero real part and negative real part using Routh's criterion. **(10 Marks)**

b. Find the gain margin and phase margin analytically for the negative feedback control system having open loop T.F. $G(s)H(s) = \dfrac{6}{(s^2 + 2s + 2)(s + 2)}$. **(10 Marks)**

OR

8 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 – locos as K is varied from 0 to infinity. **(15Marks)**

b. Explain experimental determination of frequency response. **(05 Marks)**

Module-5

9 a. For a feedback control system :

$$G(s)H(s) = \frac{40}{(s+4)(s^2+2s+2)}$$

Find gain margin and stability from Nyquist plot. **(10 Marks)**

b. Draw polar plot of $G(s)H(s) = \dfrac{100}{(s+2)(s+4)(s+8)}$ **(10 Marks)**

OR

10 a. Obtain the state equation and output equation of the electric networks as shown in Fig.Q10(a).

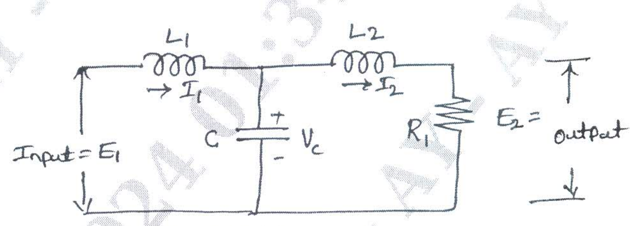

Fig.Q10(a) **(10 Marks)**

b. State the effect of lead, lag and lead – lag compensating networks. **(10 Marks)**

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