

CBCS SCHEME

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.

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.

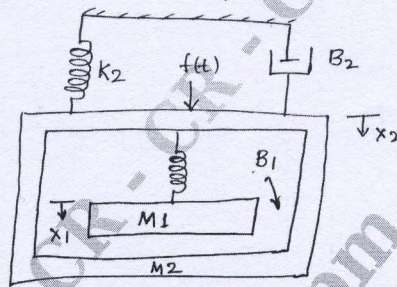


Fig.Q1(b)

(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.

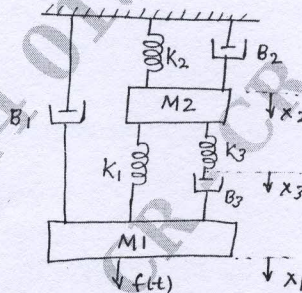


Fig.Q2(b)

(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.

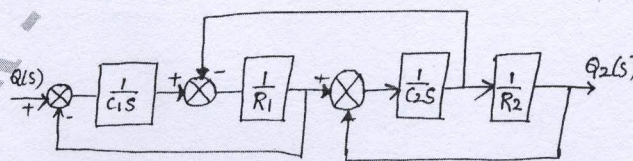


Fig.Q3(b)

(10 Marks)

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

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.

OR

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

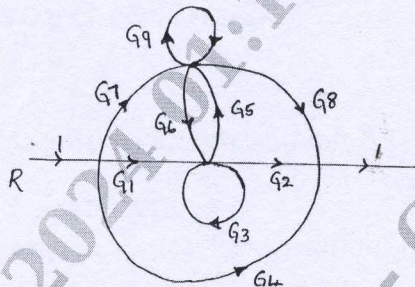


Fig.Q4(a)

(10 Marks)

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

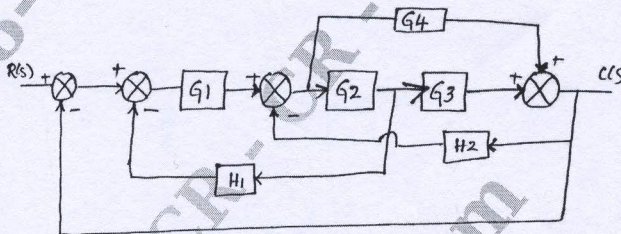


Fig.Q4(b)

(10 Marks)

Module-3

- 5 a. With the help of graphical representation and mathematical expressions, explain the following signals :
- Step signal
 - Ramp signal
 - Impulse signal
 - Parabolic signal.
- b. Derive an expression for the under-damped response of a second order feedback control system for step input.

(10 Marks)

(10 Marks)

OR

- 6 a. For the system shown in the Fig.Q6(a)

- Identify the type of $\frac{C(s)}{E(s)}$
- Find the values of k_p, k_v, k_a
- If $r(t) = 10u(t)$, find the steady state value of the output.

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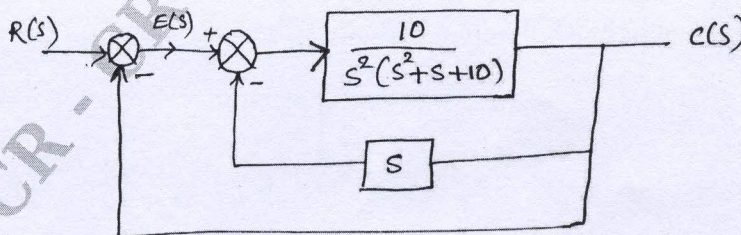


Fig.Q6(a)

(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. $G(s)H(s) = \frac{6}{(s^2 + 2s + 2)(s + 2)}$. (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-locus as K is varied from 0 to infinity. (15 Marks)
- 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 $G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}$. (10 Marks)

OR

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

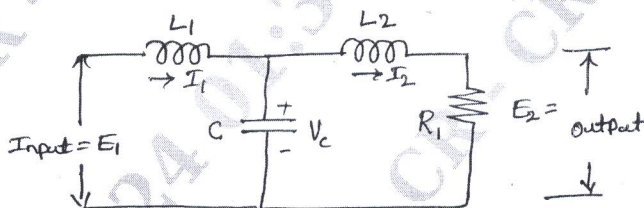


Fig.Q10(a)

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