

CBCS SCHEME

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15ME73



Seventh Semester B.E. Degree Examination, July/August 2021

Control Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Define control system. Compare open loop and closed loop control system with an example. (08 Marks)
- b. What are the requirements of an Ideal Control System? (08 Marks)
- 2 Explain with Block diagrams:
 - (i) Proportional controller. (ii) Integral controller.
 - (iii) Derivative controller. (iv) P.I.D controller.(16 Marks)
- 3 a. Draw F-V and F-C circuits using analogue quantities. (08 Marks)

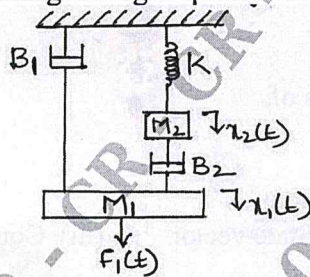


Fig. Q3 (a)

- b. Determine the overall transfer function of a block diagram shown in Fig. Q3 (b). (08 Marks)

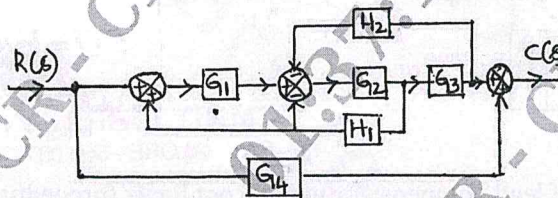


Fig. Q3 (b)

- 4 a. Determine the transfer function of field controlled DC motor which relates output angular displacement (θ) with input voltage (e_f). (08 Marks)
- b. Obtain the overall TF of SFG given:

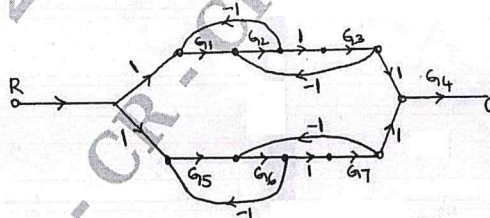


Fig. Q4 (b)

- 5 a. Discuss the various standard inputs used in control system analysis. (04 Marks)
- b. Derive the response equation of 1st order system for unit step input. (06 Marks)
- c. Applying RH criterion, discuss the stability of closed loop system as a function of K for the following OLTF,

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}$$

(06 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.

- 6 Sketch the Root locus plot for $G(s)H(s) = \frac{K}{s(s+2)(s+4)(s+6)}$. For what values of K, the system becomes UNSTABLE. (16 Marks)
- 7 a. Sketch the Polar plot for the transfer function, $G(s) = \frac{1}{(1+s)(1+2s)}$. (06 Marks)
- b. Apply Nyquist stability interior to the system with loop transfer function, $G(s)H(s) = \frac{4s+1}{s^2(1+s)(1+2s)}$. Ascertain its stability. (10 Marks)
- 8 For a unity feedback system with OLTF, $G(s) = \frac{40(s+5)}{s(s+10)(s+2)}$. Draw the Bode plot and determine : GM, PM, ω_{gc} , ω_{pc} . Comment on the stability of the system. (16 Marks)
- 9 a. Write down the characteristics of,
 (i) Lag compensator
 (ii) Lead compensator.
 (iii) Lag-lead compensator. (09 Marks)
- b. Define : (i) State (ii) State vector (iii) Controllability (iv) Observability (07 Marks)
- 10 a. Find the controllability and observability of the system described by the state equation:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u;$$
 $y = [1 \ 0]x.$ (08 Marks)
- b. Explain the design of lead compensator using Root locus (procedure only). (08 Marks)
