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18AE732

Seventh Semester B.E. Degree Examination, July/August 2022
Control Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- Define control systems with block diagram and examples, explain open and closed loop control system. (12 Marks)
 - What are the requirements of an ideal control system? (08 Marks)

OR

- Obtain the transfer function of field controlled DC motor. (10 Marks)
 - Write the differential equations governing the mechanical system. Also draw F-V and F-I analogous circuits. [Refer Fig.Q2(b)]

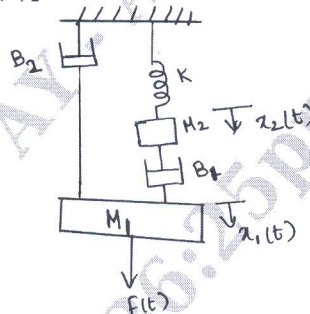


Fig.Q2(b)

(10 Marks)

Module-2

- Obtain the overall transfer function for the block diagram. [Refer Fig.Q3(a)]
S – Summing point T – Take-off point

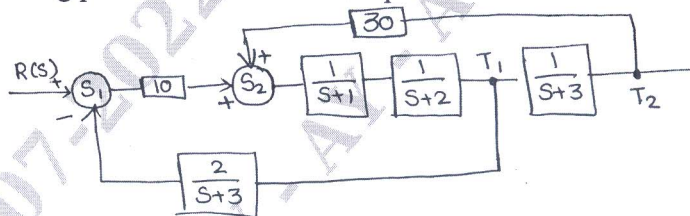


Fig.Q3(a)

(10 Marks)

- Find the transfer function $\frac{C(s)}{R(s)}$ by Mason's formula. [Refer Fig.Q3(b)]

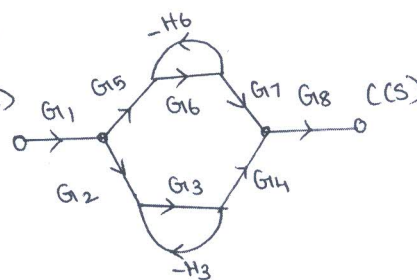


Fig.Q3(b)

(10 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. Obtain an expression for response of the first order system subjected to unit step input. (10 Marks)
- b. The OLTF of a unity negative feedback control system is $G(s) = \frac{25}{s(s+5)}$. Obtain its maximum overshoot, peak time, rise time and settling time. (10 Marks)

Module-3

- 5 Sketch the root locus for the system having

$$G(s)H(s) = \frac{K}{s(s+1)(s+2)(s+3)} \quad (20 \text{ Marks})$$

OR

- 6 For a unity feedback system $G(s) = \frac{K}{s(s+2)(s+10)}$. Determine marginal value of 'K' for which system will be marginally stable, using Bode plot. (20 Marks)

Module-4

- 7 a. Differentiate between time domain and frequency domain. (08 Marks)
- b. Obtain polar plot for open loop transfer function $G(s)H(s) = \frac{1}{(1+T_1S)(1+T_2S)}$. (12 Marks)

OR

- 8 a. Explain the principle of argument. (08 Marks)
- b. 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. (12 Marks)

Module-5

- 9 a. Explain the need for system compensation. List the types of compensation used. (10 Marks)
- b. With a block diagram, explain proportional, integral and differential controller. (10 Marks)

OR

- 10 Consider the system defined by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

$$y = [10 \quad 5 \quad 1] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Check the controllability of the system using Gilbert's test and Kalman's test. (20 Marks)
