

CBCS SCHEME



18ME71

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Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Control Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain closed loop system with an example. (06 Marks)
- b. What are the ideal requirements of a control system? Explain them briefly. (06 Marks)
- c. Explain proportional plus integral plus derivative control action with the characteristics. (08 Marks)

OR

- 2 a. Draw the equivalent mechanical system of the given system shown in Fig.Q2(a). Hence the set of equilibrium equations for it and obtain electrical analogous circuits using (i) F-V analogy (ii) F-I analogy.

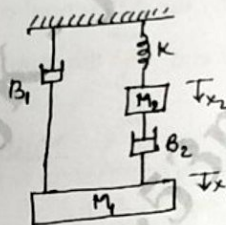


Fig.Q2(a)

(12 Marks)

- b. A thermometer is dipped in a vessel containing liquid at a constant temperature of $\theta_1(t)$. The thermometer has a thermal capacitance for storing heat as 'C' and thermal resistance to limit heat flow as R. If the temperature indicated by the thermometer is $\theta_0(t)$. Obtain the transfer function of the system. (08 Marks)

Module-2

- 3 a. Obtain an expression for response of first order system for unit step input. (06 Marks)
- b. Explain different types of input signals. (06 Marks)
- c. Obtain an expression for response of first order system for parabolic input. (08 Marks)

OR

- 4 a. Derive the expression of steady state error for a simple closed loop system and state the factors on which it depends. (10 Marks)
- b. A second order system has natural frequency $\omega_n = 5$ rad/sec and damping ratio is 0.6. Calculate (i) Delay time (ii) Rise time (iii) Peak time (iv) Maximum overshoot. (10 Marks)

Module-3

- 5 a. Reduce the given block diagram shown in Fig.Q5(a) and obtain the transfer function $C(s)/R(s)$.

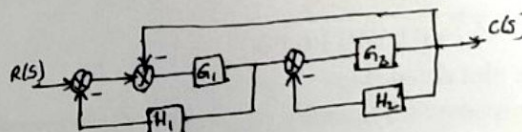


Fig.Q5(a)

(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.

- b. Find the overall transfer function by using Mason's gain formula for the signal flow graph shown in the Fig.Q5(b).

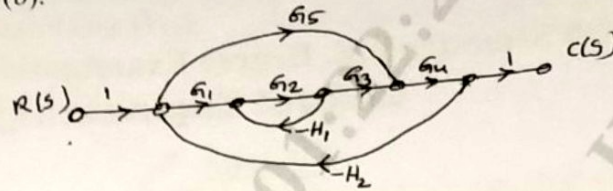


Fig.Q5(b)

(10 Marks)

OR

- 6 a. Draw the corresponding signal flow graph of a given block diagram in Fig.Q6(a) and obtain transfer function by using Mason's gain formula.

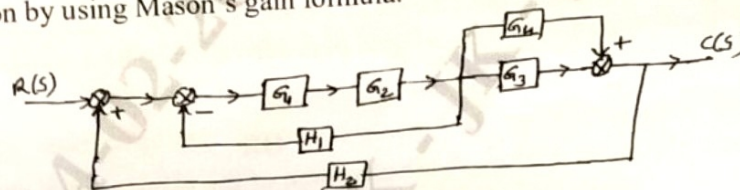


Fig.Q6(a)

(10 Marks)

- b. A system is governed by the differential equation $\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 10y = 8u(t)$ where y is the output and u is the input of the system. Obtain a state space representation of the system. (10 Marks)

Module-4

- 7 a. The characteristic equation of a system is given by $s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$. Determine the stability using RH criteria. (08 Marks)
- b. By applying Routh criterion, discuss the stability of the closed loop system as a function of K for the following open loop transfer function $G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}$ (12 Marks)

OR

- 8 Sketch the rough nature of root locus of a given transfer function

$$G(s)H(s) = \frac{K(s+1)}{s(s+2)(s^2+2s+5)}$$

(20 Marks)

Module-5

- 9 a. Sketch the polar plot of given transfer function

$$G(s)H(s) = \frac{1}{s(1+5s)(1+10s)}$$

(06 Marks)

- b. The transfer function $G(s)H(s) = \frac{10}{s(s+1)(s+2)}$

Sketch the rough nature of Nyquist plot and comment on stability.

(14 Marks)

OR

- 10 Draw the Bode plot for the transfer function

$$G(s) = \frac{36(1+0.2s)}{s^2(1+0.05s)(1+0.01s)}$$

From Bode plot determine :

- (i) Phase crossover frequency (ii) Gain crossover frequency
 (iii) Gain margin (iv) Phase margin

(20 Marks)

** 2 of 2 **

