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**T 3257**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Fourth Semester

Mechatronics Engineering

EE 1264 — CONTROL SYSTEMS

(Regulation 2004)

Polar, Semilog graph sheets are to be provided.

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How are the control systems classified?
2. Explain the significance of actuating signal.
3. Name some of the standard test signals.
4. Define the rise time of a control system.
5. List the advantages of logarithmic plots.
6. What does the resonant frequency infer?
7. Write about different types of roots and their response terms.
8. What are the necessary conditions for stability?
9. Explain the necessity of compensation in the control systems.
10. What are the performance specifications to be met by the control system while designing for a specific application?

PART B — (5 × 16 = 80 marks)

11. (a) Obtain the transfer function of the mechanical system shown in Fig.1 writing the physical system equations.

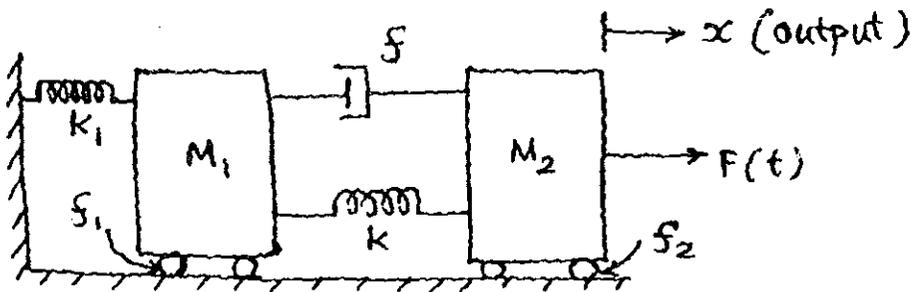


Fig. 1

(16)

Or

- (b) For the signal flow graph shown in Fig. 2, find C/R.

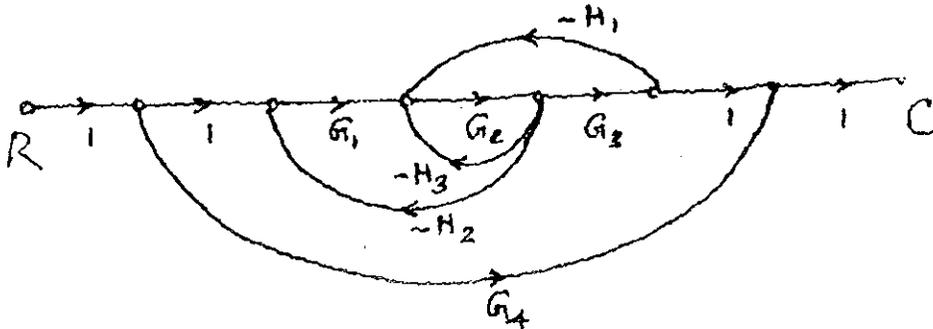


Fig. 2

(16)

12. (a) For the system given by  $\frac{C(S)}{R(S)} = \frac{\omega_n^2}{s^2 + 2\delta\omega_n s + \omega_n^2}$  obtain the unit-ramp response and steady state error.

Or

- (b) The open loop transfer function of a servo system with unity feedback is  $G(s) = \frac{10}{S(0.15S + 1)}$ . Evaluate the static error constants and obtain the steady state error of the system when subjected to an input of  $r(t) = A_0 + A_1 t + \frac{A_2}{2} t^2$ .

(16)

13. (a) Sketch the Bode plot of the transfer function given by  
$$G(s) = \frac{200(s+2)}{s(s^2+10s+100)} \quad (16)$$

Or

- (b) Sketch the polar plot for the transfer function

$$G(s) = \frac{10}{s(s+1)(s+2)} \quad (16)$$

14. (a) Ascertain the stability of the system given by the characteristic equations.

(i)  $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0.$  (8)

(ii)  $2s^5 + s^4 + 6s^3 + 3s^2 + s + 1 = 0.$  (8)

Or

- (b) The open loop transfer function of a system is given by

$$G(s), H(s) = \frac{k(s+12)}{s^2(s+20)} \quad (16)$$

Sketch the root locus for the system.

15. (a) Briefly describe the lag and lag-lead compensation schemes provided in the control systems. (16)

Or

- (b) The open loop transfer function of a unity feedback system is

$$G(s) = \frac{k}{s(s+1)}.$$
 It is desired to have the velocity error constant

$k_v = 12 \text{ sec}^{-1}$  and phase margin as  $40^\circ$ . Design a lead compensator to meet the above specifications. (16)