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D 353

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2003.

Fourth Semester

Electrical and Electronics Engineering and Mechatronics

EE 235 — CONTROL SYSTEMS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. The open loop system gain increases by 20%. Calculate the value of the change in the closed loop gain assuming unity feedback.

2. Name three functional components used in control system. Describe the role played by each of them.

3. What are the various static error constants? How are they related to the system steady state error?

4. Define the terms (a) peak over shoot and (b) settling time for an underdamped second order system.

5. Define gain margin and phase margin.

6. State the stability requirements in time domain and in frequency domain.

7. With a suitable example differentiate between regulator and servo mechanism.

8. What do you understand by lag and lead compensating networks? What part they play in the control system design?

9. What is the phase angle criterion in the root locus technique?

10. What is a Synchro? Where is it used?

PART B — (5 × 16 = 80 marks)

11. Find the transfer function of the system whose SFG is drawn in figure 11.

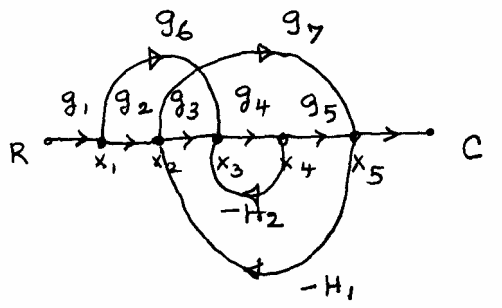

Fig. 11

12. (a) Find the transfer function of the control system shown in figure 12 (a).

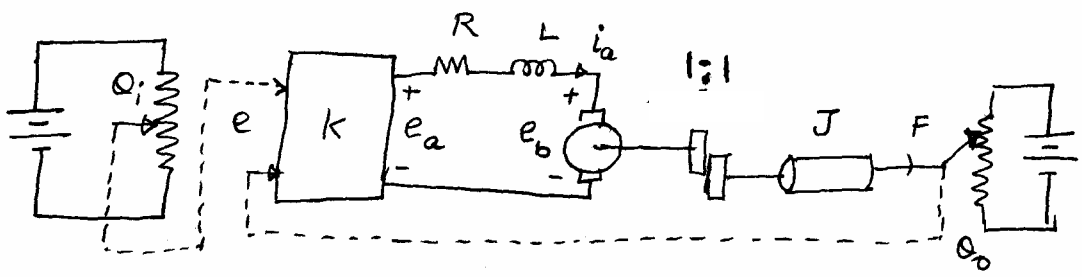

Fig. 12(a)

Or

(b) A unity feedback system has an open loop transfer function $G(s) = \dfrac{25}{s(s+8)}$. Determine its damping ratio, peak over shoot and time required to reach the peak output. Now a proportional component having a gain of [3.2] is introduced in the system. Discuss its effects on the values obtained above.

13. (a) The response of a system subjected to a unit step input is $c(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$. Obtain the expression for the closed–loop transfer function. Also determine the undamped natural frequency and damping ratio of the system.

Or

(b) Sketch the Nyquist plot for the following transfer function of a control system $G(s) = \frac{K}{(s+2)(s+6)}$ for a system gain $K = 60$.

14. (a) Sketch the root locus for $GH(s) = \frac{K(s+2)(s+3)}{(s+1)(s-1)}$.

Or

(b) Design a suitable compensator for a control system having transfer function as $G(s) = \frac{1}{s(s+1)(s+5)}$ to meet the specifications (i) overshoot of about 25% and (ii) settling time of 5 sec.

15. (a) For the system given by the characteristic polynomial $s^6 + 4s^5 + 17s^4 + 56s^3 + 667s^2 + 2500s + 1875$. Obtain the root distribution and comment on its stability.

Or

(b) Explain the use of M circles and N circles for the study of stability of the system.