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Question Paper Code : P 1357

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fourth Semester

Electrical and Electronics Engineering

IC 1251 — CONTROL SYSTEMS

(Regulation 2004)

(Common to B.E. – Instrumentation and Control Engineering)

(Common to B.E. (Part-Time) Third Semester – EEE – Regulation 2005)

Time : Three hours

Maximum : 100 marks

Semilog sheets will be provided on demand.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the two assumptions to be made while deriving Transfer function of Electrical systems?

2. Define Signal flow graph.

3. Define Step Signal.

4. What do you mean by static error constants?

5. Define Gain Margin.

6. What are the advantages of Bode plot?

7. What are the conditions to be satisfied for a linear time-invariant system to be stable?

8. Define Root Loci (RL) and Root Contours (RC).

9. What are the different types of compensating network?

10. What is the function of a controller?

PART B — ($5 \times 16 = 80$ marks)

11. (a) Write the differential equations governing the mechanical system shown in Fig. 11 (a). Draw the force voltage and force current electrical analogous circuits and verify by writing mesh and node equations.

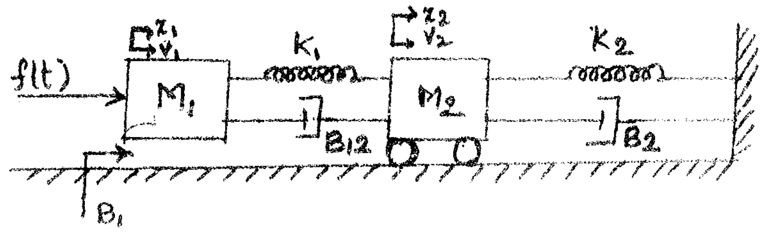

Fig. 11 (a)

Or

(b) Using block diagram reduction techniques find closed loop transfer function of the system whose block diagram shown in Figure 11 (b).

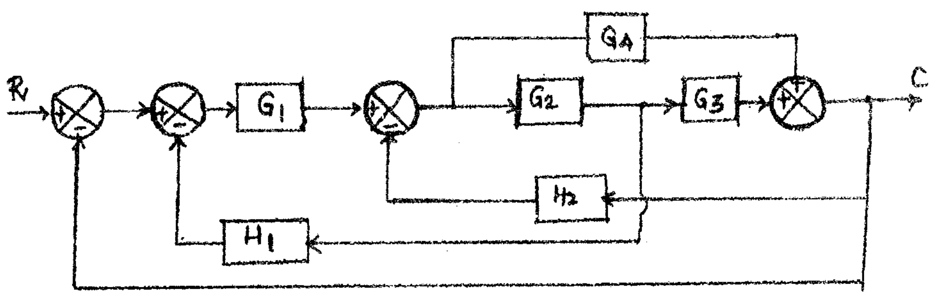

Fig. 11 (b)

12. (a) Using generalized error series calculate the steady state error of a unity feedback system having $G(s) = \dfrac{10}{(s+2)}$ for the following excitation.

(i) $r(t) = 2$

(ii) $r(t) = 2t$

(iii) $r(t) = \dfrac{t^2}{2}$

(iv) $r(t) = 1 + 2t + \dfrac{t^2}{2}$

Or

(b) Fig. 12 (b) shows a unity feedback system. Calculate ξ and ω_n when $K = 0$. Also determine K when $\xi = 0.6$.

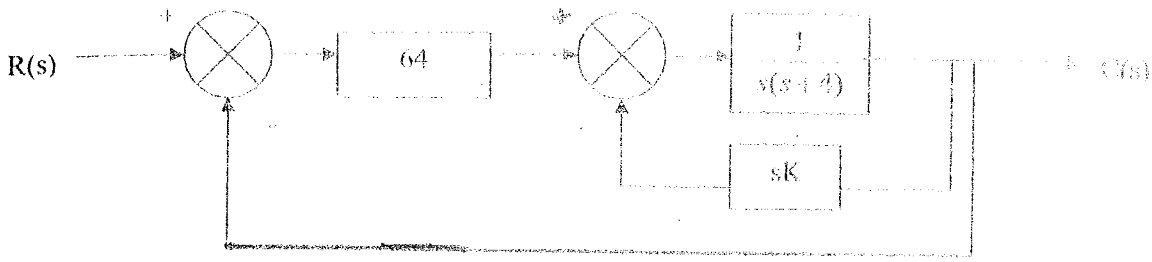

Fig. 12 (b)

13. (a) Sketch the Bode plot for the transfer function $G(s)H(s) = \dfrac{Ks^2}{(1+0.2s)(1+0.02s)}$. Find K for a gain cross over frequency of 5 rad/sec.

Or

(b) For a system with $G(s)H(s) = \dfrac{400}{s(s+2)(s+10)}$. Draw the polar plot.

14. (a) Write the characteristics equation and construct Routh array for the control system shown in Fig. 14 (a). It is stable for

(i) $Kc = 9.5$

(ii) $Kc = 11$

(iii) $Kc = 12$.

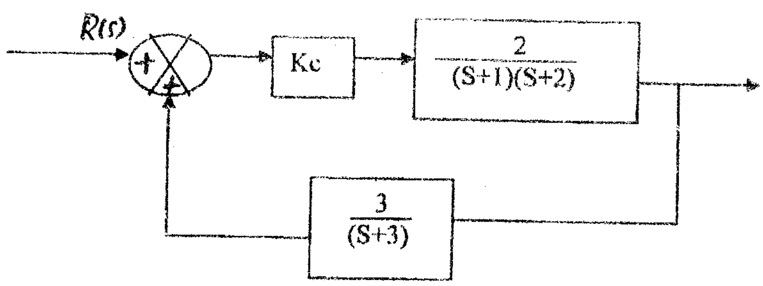

Fig. 14 (a)

Or

(b) For $G(s)H(s) = \dfrac{1}{s^2(s+2)}$. Sketch the Nyquist plot and determine the stability of the system.

15. (a) A 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 $Kv = 12\ sec^{-1}$ and phase margin as 40°. Design a lead compensator to meet the above specification.

Or

(b) For $G(s) = \frac{K}{s(s+2)(s+20)}$. Design a lag compensator given phase magnitude $\geq 35°$ and $Kv \leq 20$.