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## Fourth Semester B.E. Degree Examination, Dec.09-Jan.10 Control Systems

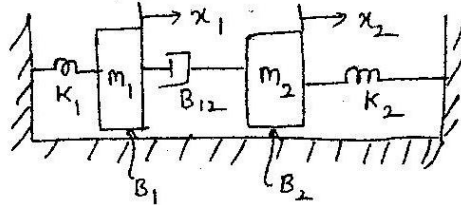
Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions.**

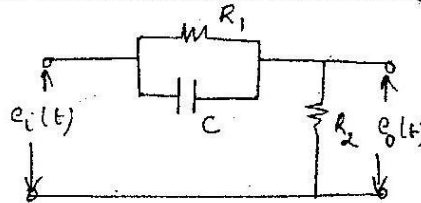
- 1 a. Distinguish between open loop and closed loop systems with examples. (06 Marks)  
 b. For the mechanical system shown in Fig.1(b), find the transfer function  $X(s) / F(s)$ . (08 Marks)

Fig.1(b)

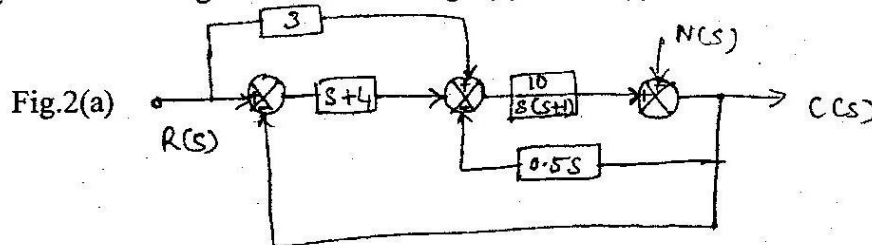


- c. Obtain the Transfer function of the Lead Network shown in Fig.1(c). (06 Marks)

Fig.1(c)

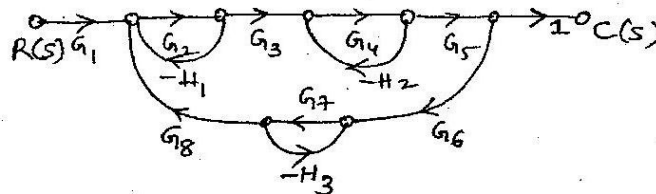


- 2 a. The system block diagram is shown in Fig.2(a); find  $C(s)$ . (10 Marks)



- b. Find the Transfer function  $C(s) / R(s)$  for the signal-flow graph shown in Fig.2(b). (10 Marks)

Fig.2(b)



- 3 a. Obtain the step response of I order system. (06 Marks)  
 b. A positional servomechanism is characterized by an open loop Transfer function  $G(s) = \frac{A}{s(s+\alpha)}$  where A and  $\alpha$  are constants. Find the values of A and  $\alpha$  so that  $\delta = 0.6$  and frequency of damped oscillations  $W_d = 8$  rad/sec. Also find the peak value of response when the system is excited by a step voltage of 2V. (08 Marks)  
 c. A unity feedback system has  $G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$ . Find all error constants and steady state error. Also find type and order of system with  $r(f) = 4t$ . (06 Marks)

- 4 a. Obtain the relationship between characteristic equation roots and BIBO stability. (10 Marks)  
 b. A system oscillates with a frequency  $\omega$  if system has poles at  $s = \pm j\omega$  and no poles in right half of  $s$ -plane. Determine the values of  $k$  and  $a$  so that system shown in Fig.4(b) oscillates at a frequency of 2 rad/sec. (10 Marks)

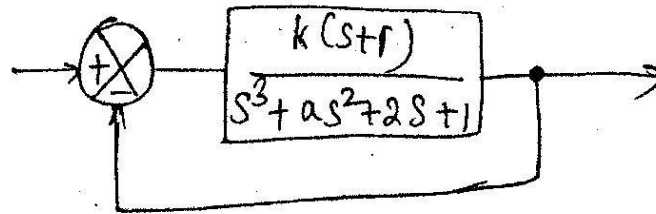


Fig.4(b)

- 5 a. Explain the terms i) Asymptotes; ii) Centroid; iii) Breakaway points. (06 Marks)  
 b. Sketch complete root locus by stating rules as  $K$  is varied from 0 to  $\infty$  for the open loop transfer function given by  $G(s) = \frac{K}{s(s+2)(s^2+6s+25)}$  (14 Marks)

- 6 a. Find frequency-domain specifications with a unity feedback system having  $G(s) = \frac{36}{s(s+8)}$ . (08 Marks)  
 b. Define Gain margin and phase margin. (04 Marks)  
 c. Find the polar plot of function  $\frac{14}{s(s+1)(s+2)}$  (08 Marks)

- 7 a. The open loop Transfer function of a unity feedback system is given by  $G(s) = \frac{10(s+3)}{s(s+2)(s^2+4s+100)}$ . Draw Bode plots and find G.M and P.M. (12 Marks)  
 b. The Bode diagram for a particular system is shown in Fig.7(b). Answer the following  
 i) At what  $\omega_1$  does the plot cross the magnitude of  $-20$ db?; ii) At what magnitude of  $A_1$  does the plot cross  $\omega = 10$ ?; iii) At what magnitudes of  $A_2$  does the break from  $-20$ db to  $-40$ db slope at  $\omega = 1000$  occur?; iv) At what  $\omega_2$  does the diagram cross the magnitude of  $-40$ db? (08 Marks)

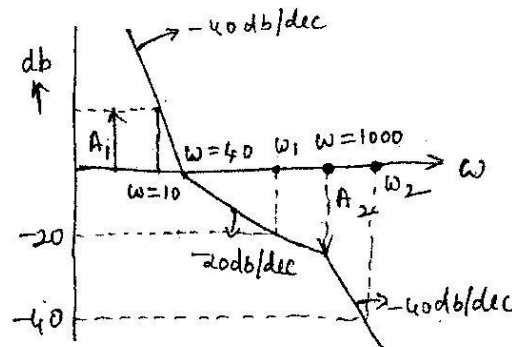


Fig.7(b)

- 8 a. Explain Nyquist stability criterion. (06 Marks)  
 b. Explain the terms i) Absolute stability; ii) Relative stability. (04 Marks)  
 c. For feedback control system  $G(s)H(s) = \frac{40}{(s+4)(s^2+2s+2)}$ , find G.M. and stability from Nyquist plot. (10 Marks)

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