

Con. 3343-08.

CO-9984  
MASTOR

(REVISED COURSE)

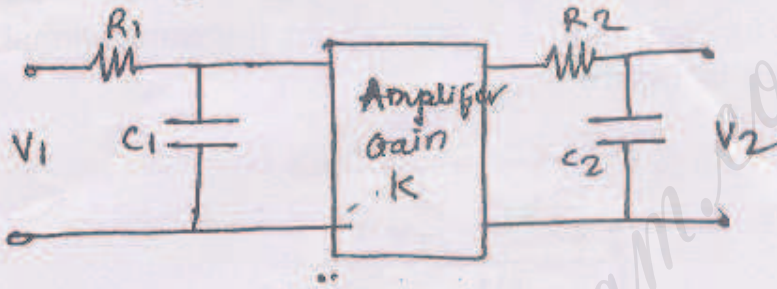
(3 Hours)

[Total Marks : 100

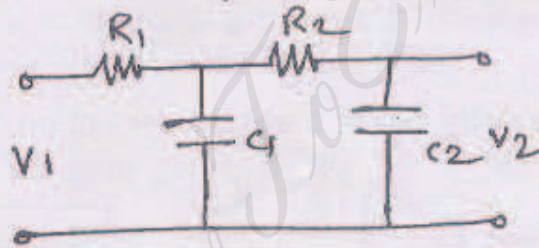
- N.B. : (1) Question No. 1 is compulsory.  
 (2) Attempt any four questions from remaining.  
 (3) All questions carries equal marks.

1. Attempt any four :-

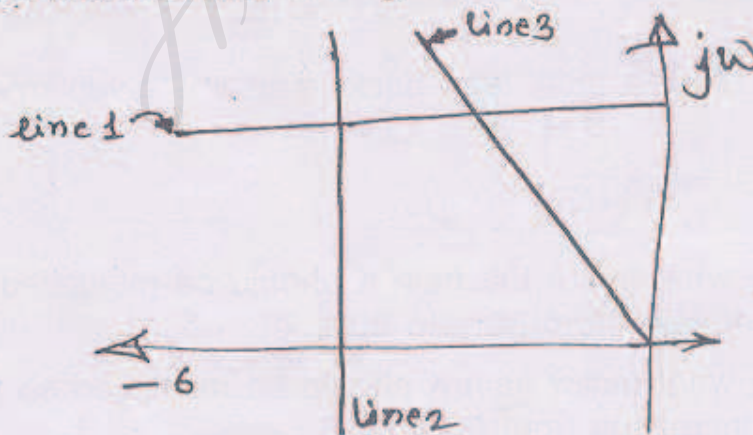
(a) Find the voltage transfer function for Figure.



- (b) Derive the expression for peak time  $t_p$ .  
 (c) Find transfer function by Mason's gain formula for figure.



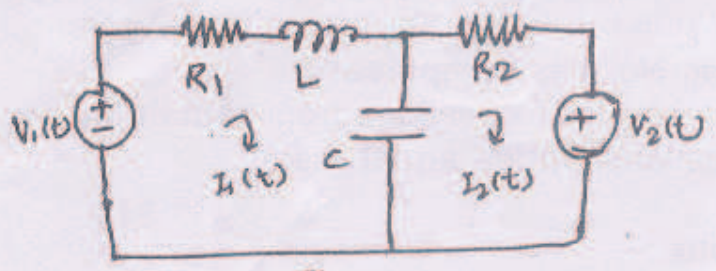
(d) Figure shows lines of constant peak time  $t_p$ , constant overshoot  $\%M_p$ , and constant settling time  $t_s$ , identify them and write your answer.



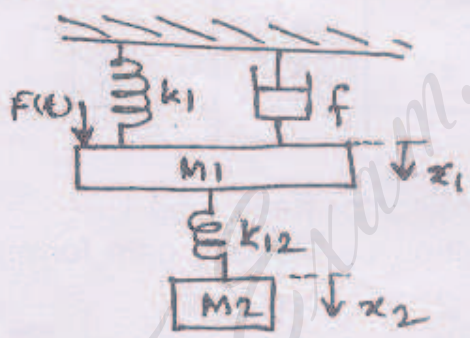
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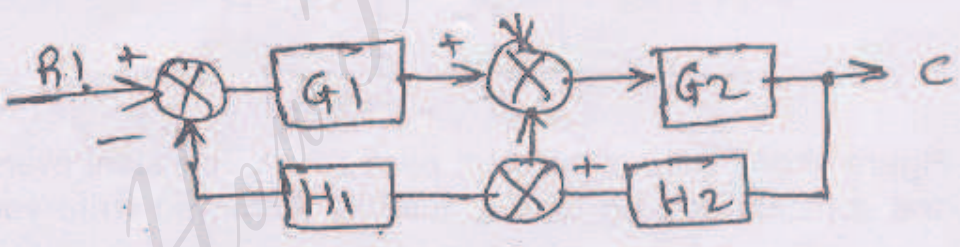
(e) Find the state space representation for the figure assuming that the outputs are the currents flowing through R1 and R2.



2. (a) Find transfer function  $G(s) = x_2(s)/F(s)$ , for the translational mechanical system shown in figure.



(b) Find transfer function by block diagram reduction for figure.



3. (a) Open loop T. F. of a unity feed back system is given by—

$$G(s) = \frac{K}{s(1+ST)}$$

- (i) Find by what factor the gain K should be multiplied so that over shoot reduces from 80% to 20%.
- (ii) Find by what factor gain K should be multiplied so that damping Ration increases from 0.2 to 0.6.



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(b) For a unity feed back system  $G(s) = \frac{K}{S(S+1)(1+0.4S)}$

- (i) If  $r(t) = 4t$  and  $k = 2$  find steady state error.
- (ii) If it is desired to have steady state error to be 0.2. Find the corresponding value of K.
- (iii) Find the steady state error if input is  $r(t) = 2 + 6t$  and  $K = 10$ .

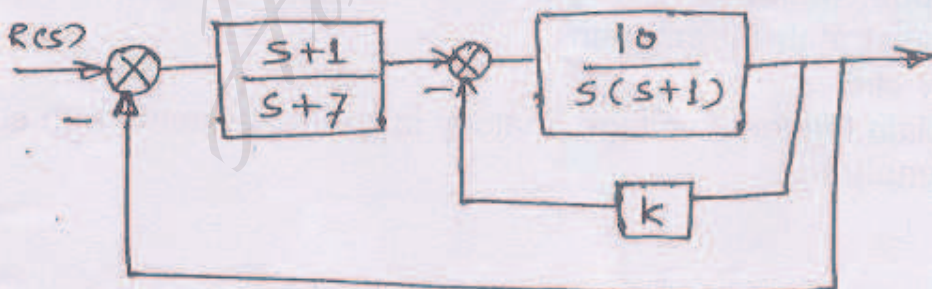
4. (a) Open loop transfer function of a unity feed back system is given by—

$$G(s) = \frac{K}{S(S^2 + 8S + T)}$$

- (i) Determine the relation between K and T for stable system.
  - (ii) Find the relation between K and T for all roots of the system to lie on left of  $S = -1$  line.
  - (iii) Plot the stable region K verses T in both cases.
- (b) Determine the resonant frequency, resonant peak and bandwidth for the system given by transfer function—

$$\frac{C(s)}{R(s)} = \frac{5}{s^2 + 2s + 5}$$

5. (a) Sketch the root locus for the figure.



(b) Explain how  $k_p$ ,  $k_v$ , and  $k_a$  can be calculated from Bode plot.

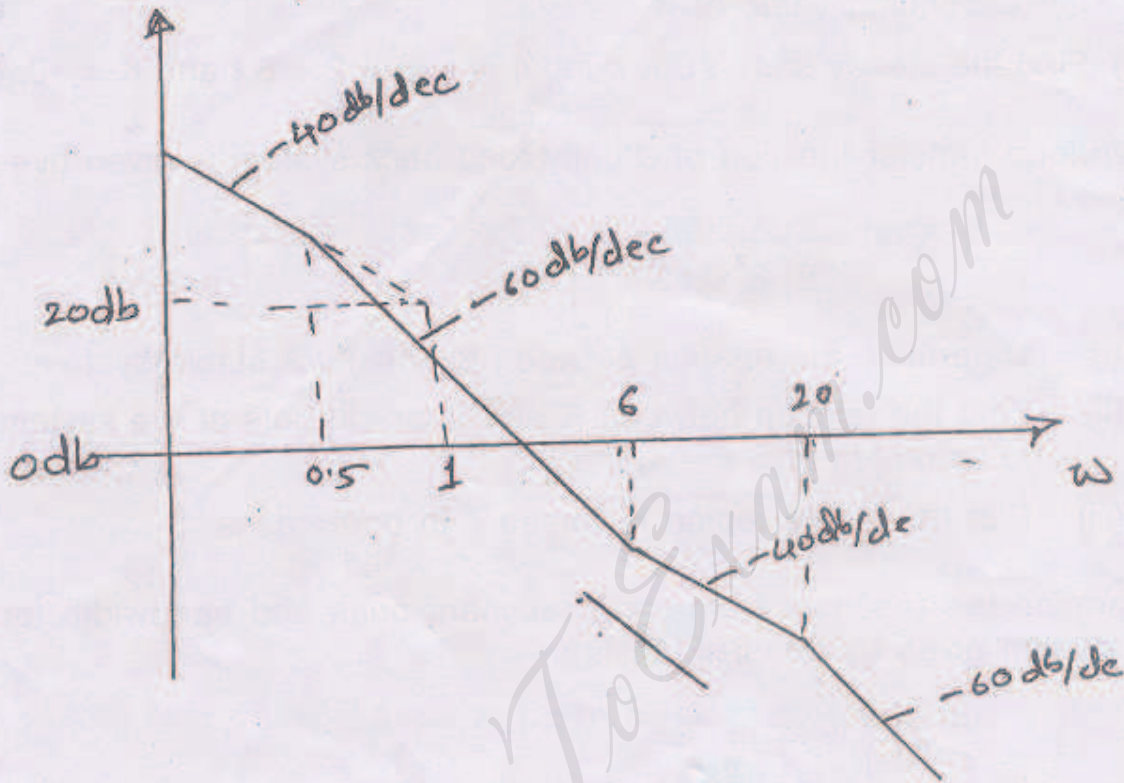
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6. (a) Draw the Bode plot for  $G(s)H(s) = \frac{800(s+2)}{s^2(s+10)(s+40)}$

(b) Find the transfer function from the Bode magnitude plot shown in figure.



7. Write short notes on any **three** :-

- (a) Stepper motor
- (b) Nyquist stability criterion
- (c) M-N circles
- (d) Explain the force voltage analogy in control systems with suitable example.