PRN:		Course Code:	AER3504

Third Year **B. Tech** End Semester Examination Winter 2024

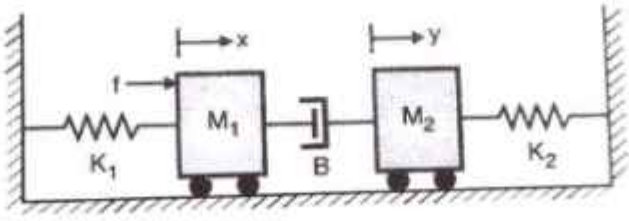
Control Engineering

Day and Date: Tue 26 NOV 2024 Max Marks: **100**

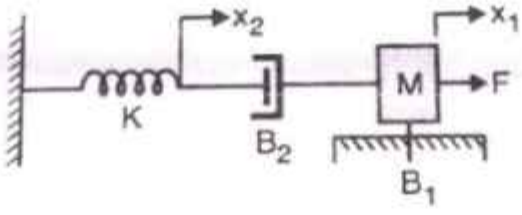
Time: 10:30AM To 01:30PM Duration: **03** hrs

Instructions: All questions are compulsory.

Q.1	**Attempt the following**	Marks	Bloom's Level	CO
a)	Find the Grounded Chair representation and required relationships of F, x, and y	08	4	CO1

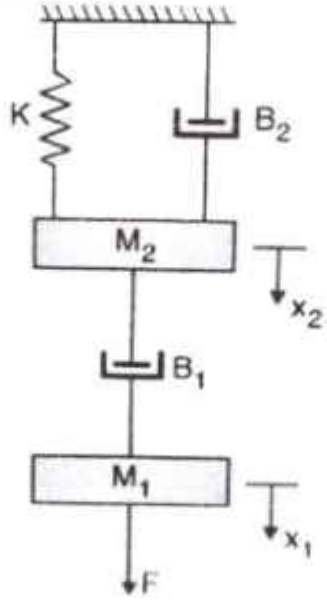


b)	Obtain the differential equation for the mechanical system and draw force voltage analogy-	08	4	CO1



OR

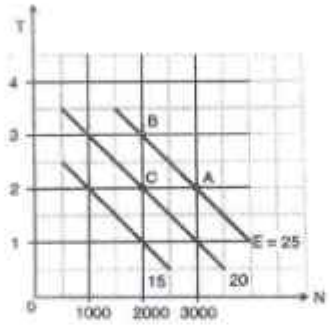
b)	Obtain the differential equation for the mechanical system and draw force voltage analogy-	08	4	CO1



Backlog

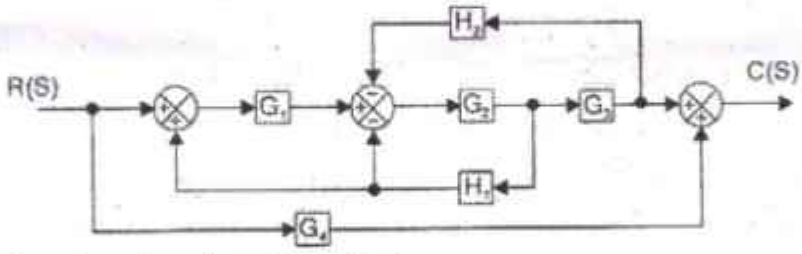
Q.2 **Attempt the following**

a)	The sonic flow of air through restriction has mass flow rare $M = (0.04)A\frac{P}{\sqrt{T}}$, where M – mass flow rate, T – inlet temperature, A = area of restriction and P = inlet pressure. Consider the inlet temperature is constant . Determine the linearized approximation for the variation of mass in terms of reference value	08	4	CO2
b)	The typical operating curves for a DC motor are shown in figure. These given relation between torque T verses operating speed N for constant value applied voltage E to the motor. Effect a liner approximation for speed N	08	4	CO2



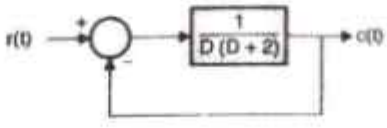
OR

b)	Solve the block diagram	08	4	CO2



Q.3 **Attempt any two from the following**

a)	A system is having forward path function $G(s) = \frac{16}{s(s+1)}$ and feedback function (1+Ks) what should be the value of K to obtain damping ratio 0.6. Also calculate undamped natural frequency, percentage peak overshoot and setting time.	08	4	CO3
b)	Obtain unit step response of a unity feedback system having an open loop transfer function $G(s) = \frac{4}{s(s+5)}$	08	4	CO3
c)	A system for controlling the temperature of an electric furnace is shown in the figure. Determine the response c(t) for following case $r(t) = u(t);\ C(0) = 0\ and\ \dot{C}(0) = 0$	08	4	CO3



Backlog

Q.4	**Attempt any two from the following**				
	a)	Draw Bode Plot for $G(s) = \frac{10}{s(s+1)(s+5)}$ and find phase and gain margin	08	4	CO4
	b)	The open loop transfer function of an unit feedback system is given by $G(s) = \frac{10(s+3)}{s(s+2)(s^2+4s+100)}$ draw bode plot and find phase margin and gain margin.	08	4	CO4
	c)	Derive expression for Lead-Lag Compensator	08	4	CO4
Q.5	**Attempt any Two of the following**				
	a)	Using Routh array determine the roots on imaginary axis of the polynomial $s^5 + 4s^4 + 8s^3 + 7s + 4 = 0$ and comment on the stability of system.	09	4	CO4
	b)	Obtain the root locus for the unity feedback system whose open loop transfer function is as below and comment on same. $$G(s) = \frac{K(s+1)}{(s-1)(s+2)(s+4)}$$	09	4	CO4
	c)	Obtain the root locus for the unity feedback system whose open loop transfer function is as below and comment on same. $$G(s) = \frac{K}{s(s^2+6s+25)}$$	09	4	CO4
Q.6	**Attempt any Two of the following**				
	a)	Determine the state space representation and computer diagram of the system given by below given by using direct method $$T(s) = \frac{2s+9}{s^3+9s^2+12s+10}$$	09	4	CO5
	b)	Determine the state space representation and computer diagram of the system given by below given by using cascade programming $$H(s) = \frac{7(s^2+3s+2)}{(s^2+8s+15)(s+10)}$$	09	4	CO5
	c)	Determine the state space representation and computer diagram of the system given by below given by using parallel programming $$T(s) = \frac{s(s+5)}{(s+1)(s+3)(s+4)}$$	09	4	CO5

*****

Backlog