PRN:		Course Code:	UAE304

Second Year **B. Tech** End Semester Examination Winter 2023

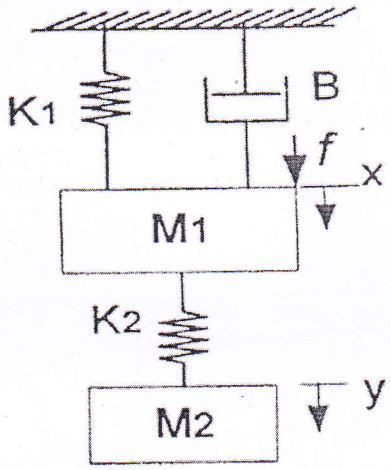
Control Engineering

Day and Date: Tuesday 05/12/2023 Max Marks: **100**

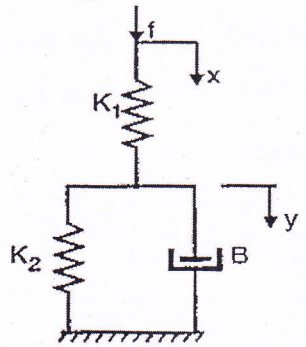
Time: 10.30 am to 1.30 pm Duration: **03** hrs

Instructions: All questions are compulsory.

		Marks	Bloom's Level	CO
Q.1	**Attempt the following**			
a)	Construct the grounded chair representation for spring, mass damper system as shown in figure. Determine the equation relating i.) f to x and ii) x and y	08	4	CO1



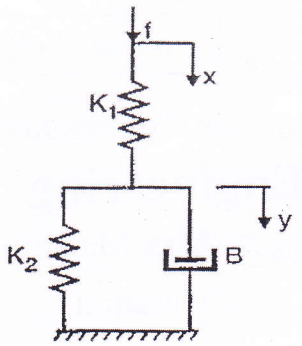
b)	Obtain the differential equation for the mechanical system and draw force current analogy-	08	4	CO1



OR

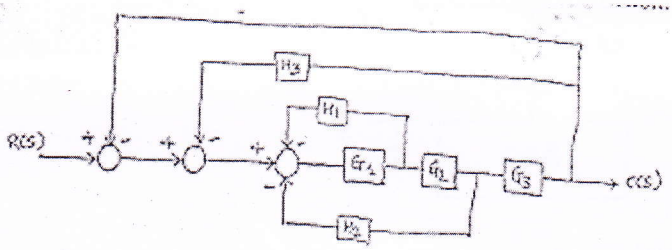
b)	Obtain the differential equation for the mechanical system and draw force voltage analogy-	08	4	CO1

ESE



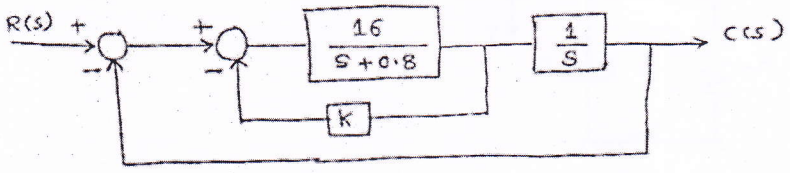
Q.2 **Attempt the following**

a)	Velocity through pipe is determined by the relation $V = \frac{32Q^2}{2\pi^2 D^4}$ where Q is the volume flow rate (discharge) and D is diameter of the pipe. Determine the linearized approximation for variation of velocity. The ref. conditions are Qi = 115 m^3/s, Di = 65 mm. Determine the percentage error in using this approximation for V when Q = 125m^3/s and D is 60 mm.	08	4	CO2
b)	The equation for the area of the Parallelogram is A= AB sin (θ). Determine the linear approximation for the area A. For Ai=10, Bi=9 and θi=65^0. What is approximate area when A = 15, B= 10 and θ= 59^0 . Also find the percentage error.	08	4	CO2
	OR			
b)	Solve the block diagram	08	4	CO2

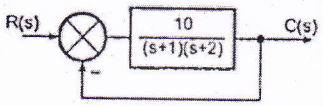


Q.3 **Attempt any two from the following**

a)	Consider the system shown in fig. Determine K " such that damping ratio 0.5 Also obtain the values of rise time ,overshoot in its step response.	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)	For the system shown in fig. obtain the damping ratio and natural frequency	08	4	CO3



Q.4	**Attempt any two from the following**				
	a)	The open loop transfer function of a unit feedback system is given by $(s) = \frac{10(s+20)}{(s+1)(s+2)(s+10)}$ draw bode plot and find phase margin and gain margin	08	4	CO4
	b)	The open loop transfer function of a unit feedback system is given by $G(s) = \frac{K}{s(1+0.02s)(1+0.04s)}$ draw bode plot and find phase margin and gain margin	08	4	CO4
	c)	Derive expression for Lead Compensator	08	4	CO4
Q.5	**Attempt any Two of the following**				
	a)	Use Routh's Array to solve this and find the range of K - $12s^4 + 10s^3 + 12s^2 + 22s + K = 0$	09	4	CO4
	b)	Use Routh's Array to solve $4s^4 + 5s^3 + 21s^2 + 36s + 10 = 0$	09	4	CO4
	c)	Draw the root locus for the unity feedback system whose open loop transfer function is $(s) = \frac{K}{s(s^2+6s+25)}$.	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 using direct method $$T(s) = \frac{s^2 + 2s + 9}{s^3 + 7s^2 + 15s + 7}$$	09	4	CO5
	b)	Determine the state space representation and computer diagram of the system given by below given by using cascade programming $$H(s) = \frac{(s+1)}{(s+2)(s+3)(s+4)}$$	09	4	CO5
	c)	Determine the state space representation and computer diagram of the system given by below given by using parallel programming $$T(s) = \frac{(s+5)}{(s+1)(s+2)(s+3)}$$	09	4	CO5

*****

ESE