Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Program Name: B.TECH-ADE **Semester : VIII**
Course Name : Modeling and Simulation **Time : 03 hrs.**
Course Code : MECH4006P **Max. Marks: 100**
Nos. of page(s) : 02

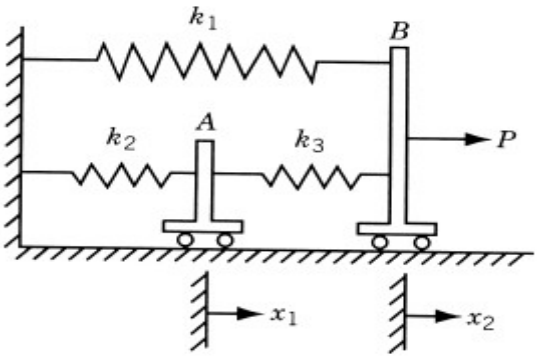
Instructions: Attempt All Questions. One question from section B and C have an internal Choice. Assume any Missing Data if required.

SECTION A

S. No.		Marks	CO
Q 1	Discuss various attributes characterizing a system by taking suitable example of any engineering system.	**4**	**CO1**
Q 2	Differentiate between various approaches used in system theories.	**4**	**CO2**
Q 3	How Lumped mass approximation helps in approximation of complex thermal engineering problem in modeling.	**4**	**CO3**
Q 4	Classify various optimization problems.	**4**	**CO4**
Q 5	Discuss various pitfalls of simulation approach.	**4**	**CO5**

SECTION B

Q 6	Obtain a linear best fit to the data given below from a chemical reactor by using the method of least squares: Concentration(g/m^3) 0.1 0.2 0.5 1 1.2 Reaction rate(g/s) 1.75 1.92 2.12 2.32 2.5 Is a linear fit satisfactory in this case?	**10**	**CO3**
Q 7	Two frictionless rigid bodies (carts) A and B connected by three linear elastic springs having spring constants k1, k2 and k3 (as shown in figure given below). The springs are at their natural positions when applied force P is zero. Find the displacement x1 and x2 by using principal of minimum potential energy.	**10**	**CO4**

			
Q 8	Minimize $f(x)=9-8x_1-6x_2-4x_3+2x_1^2+2x_2^2+x_3^2+3x_1x_2+2x_1x_3$ Subject to $x_1+x_2+2x_3=3$ By 1) Direct Substitution 2) Constrained Variation 3) Lagrange multiplier Method OR A beam of uniform rectangular cross section is to be cut from a log having circular section of diameter 6a. The beam has to be used as a cantilever beam (length is fixed) to carry concentrated load at the free end. Find the dimensions of the beam that corresponds to maximum tensile (bending) stress carrying capacity.	**10**	**CO4**
Q 9	Comprehended various steps to design or analyze a complex system by simulation with flow chart.	**10**	**CO5**
	SECTION-C		
Q 10	1) Find the dimensions of a cylindrical tin (with top and bottom) made up of sheet metal to maximize its volume such that the total surface are is equal to 36π. 2) Maximize $f=2x_1+x_2+15$ Subject to $g(x,y)=x_1+2x_2^2=3$ Find the solution using a. Method of Constrained Variation. b. Method of Lagrange Multiplier.	**20**	**CO4**
Q 11	Discuss following Simulations 1. Continuous 2. Combined Discrete-Continues 3. Monte Carlo 4. Spreadsheet **OR** Including following elements a) Problem Statement	**20**	**CO5**

	b) Program Organization and Logic c) Relevant Flow Charts d) Output and Discussion Simulate any Inventory System.		