Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May-2021

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

SECTION A (30 Marks)

1. **All questions are compulsory in this section.**
2. **Total 06 questions are there in this section and each question is of 5 Marks.**
3. **Short answer type questions.**

Assume any missing data if required.

S. No.		Marks	CO
Q1	Discuss various attributes characterizing a system by taking suitable example of any engineering system.	5	CO1
Q2	Categorize the implications of the system concept.	5	CO1
Q3	Deliberate mathematical modelling and state its importance.	5	CO2
Q4	Analyze Saddle point approach for the following function $f(x,y) = x^2 - y^2$. Predict local maximum and minimum for the function.	5	CO3
Q5	Elaborate Kuhn-tucker Condition in optimization of multivariable problem having inequality constraints.	5	CO5
Q6	Articulate pitfalls of simulation approach.	5	CO5

SECTION B (50 Marks)

1. **All questions are compulsory in this section.**
2. **Total 05 questions are there in this section and each question is of 10 Marks.**
3. **Write brief notes.**

Assume any missing data if required.

Q1	In a heat treatment process, a metal cube of side 2 cm, density 6000 kg/m3, and specific heat 300 J/kg.K is heated by convection from a hot fluid at temperature Tf =2200C. The initial temperature of the cube is, Ti =200C. If the temperature T within the cube may be taken as uniform, write down the equation that governs the temperature as a function of time τ(sec). Obtain the general form of the solution. If the measured Temperature values at different time intervals are given as τ(min): 0, 0.5, 1.0, 2.0, 3.0 $\frac{T-Tf}{Ti-Tf}$: 1, 0.85, 0.72, 0.5, 0.40.	10	CO3

	Obtain a best fit to these data using information from the analytical solution for T(τ). Sketch the resulting curve and plot the original data to indicate how good a representation of the data is obtained by this curve. From the results obtained, compute the heat transfer coefficient h.		
Q2	Apply the concept of constraint surfaces develop a hypothetical two dimensional design space. Discuss applicability and non-applicability of this approach too.	**10**	**CO4**
Q3	Compare different types of simulation approach with suitable example of each.	**10**	**CO5**
Q4	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	**[3+3+4]**	**CO4**
Q5	Summarize various steps to design or analyze a complex system by simulation with flow chart.	**10**	**CO5**
	SECTION C (20 Marks) **1. Please solve one question out of two.** **2. Write long answers.** **Assume any missing data if required.**		
Q1	a) State your understanding about Positive and negative definite in Hessian Matrix. Discuss indefinite case also. b) Find the extreme points of the function given below and calculate Relative minimum and maximum with nature of Hessian determinant. $f(x1, x2) = 4x_1^3 + 6x_2^3 + 10x_1^2 + 4x_2^2 + 8$ **OR** a)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. b) 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.	**[10+10]**	**CO4**