Name:

Enrolment No:

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

Program Name: B.TECH-Mechanical Engineering — **Semester : VII**
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
(5Qx4M=20Marks)

S. No.	Statement of question	Marks	CO
Q1	Comprehend the implications of the system concept.	**4**	**CO1**
Q2	State advantages and disadvantages of simulation approach.	**4**	**CO2**
Q3	Elaborate usage of lumped approximation in complex thermal engineering problems.	**4**	**CO3**
Q4	Determine whether the following matrix is positive or negative definite: $$[A] = \begin{bmatrix} 4 & -3 & 0 \\ -3 & 0 & 4 \\ 0 & 4 & 2 \end{bmatrix}$$	**4**	**CO4**
Q5	Analyze Kuhn-tucker condition in optimization of multivariable problem having inequality constraints.	**4**	**CO5**

SECTION B
(4Qx10M= 40 Marks)

S. No.	Statement of question	Marks	CO
Q6	Discuss following Simulations 1. Continuous 2. Combined Discrete-Continues 3. Monte Carlo 4. Spreadsheet	**10**	**CO3**
Q7	Water from a purification plant is to be stored in a tank that is located at a height of 100 m and supplies the water needed by a chemical factory. Develop different conceptual designs for achieving this task and choose the most suitable one, justifying your choice. The average consumption of water by the factory may be taken as 1000 gallons/h (3.785 m^3/h).	**10**	**CO4**
Q8	In a heat transfer experiment, the heat flux q is measured at four value of the flow velocity, which is related to the fluid flow rate. The velocity V was measured as 0, 1, 2, 3, and 4 m/s and the corresponding heat flux as 1, 2, 9, 29, and 65 W/m^2. It is desired to fit a polynomial to these points	**10**	**CO4**

	so that q may be expressed as q=f(V). What is the highest-order polynomial that may be obtained from these data? Also determine a linear best fit to the given data.		
Q9	The profit per acre of a farm is given by $$20x_1 + 26x_2 + 4x_1x_2 - 4x_1^2 - 3x_2^2$$ Where x_1 and x_2 denote, respectively, the labor cost and the fertilizer cost. Find the values of x_1 and x_2 to maximize the profit. OR The volume of sales (f) of a product is found to be a function of the number of newspaper advertisements (x) and the number of minutes of television time (y) as $$f = 12xy - x^2 - 3y^2$$ Each newspaper advertisement or each minute on television costs \$1000. How should the firm allocate \$48,000 between the two advertising media for maximizing its sales?	**[5+5]**	**CO5**
SECTION-C (2Qx20M=40 Marks)			
Q10	A rectangular beam is to be cut from a circular log of radius r. Find the cross-sectional dimensions of the beam to (a) maximize the cross-sectional area of the beam, and (b) maximize the perimeter of the beam section.	**20**	**CO4**
Q11	Create a simulation methodology for inventory control of any industry/plant. **OR** Create a simulation methodology for single server Queueing System. **(Note- please mention problem statement, logic, relevant flow charts, output and discussion.)**	**20**	**CO5**