Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End semester Examination, December 2023

Programme Name: B. Tech. (CERP) **Semester : V**
Course Name : Process Optimization **Time : 3 hrs**
Course Code : CHCE 3020 **Max. Marks : 100**
Nos. of page(s) : 01

SECTION A
(5X4=20 marks)

S. No.		Marks	CO
1	An aquarium with square bottom and open top that hold 4 cubic meters of water need to be made. You need to minimize the utilization of glass. **Recognize** the optimum dimensions of the aquarium.	**4**	**CO1**
2	**Recognize** the minimum value of the objective function C=4x+3y subjected to constraints -3x+2y≤6 3x+y≤3 and y≥0.	**4**	**CO1**
3	**What** is regression and how is it related to optimization?	**4**	**CO2**
4	$f(x) = x^7 - 1000$ **solve** using Newtons method.	**4**	**CO2**
5	**Optimize** the cost of a cylinder that holds 2 Lts of water where the bottom and top of the cylinder costs Rs. 3 per cm^2 and the sides of the cylinder costs Rs.2 per cm^2.	**4**	**CO2**

SECTION B
(4 X 10=40 marks)

6	**Perform** Newton's second order method to minimize the function. $f(x_1, x_2) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$ from the starting point $\begin{Bmatrix} -1.2 \\ 1.0 \end{Bmatrix}$.	**10**	**CO1**
7	Consider a linear system AX=B and **solve** the system by using conjugate gradient method with an initial value of X as $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$ A=$\begin{bmatrix} 5 & 1 \\ 1 & 8 \end{bmatrix}$ and B=$\begin{bmatrix} 3 \\ 2 \end{bmatrix}$	**10**	**CO1**
8	For the given function $f(x) = x_1^2 + x_2^2 + 3x_1x_2$ **find** the conjugate direction if the starting direction is $\begin{bmatrix} 1 \\ 0 \end{bmatrix}$	**10**	**CO2**
9	**Maximize** $f(x, y) = x^2y$ *subject to* $x^2 + y^2 = 1$ using Lagrange multipliers method.	**10**	**CO2**

SECTION C
(2 X 20=40 marks)

10	The reaction-rate constant for the decomposition of a substituted dibasic acid has been determined at various temperatures as given in Table 1. Use the method of least squares to **determine** the activation energy *E* in the equation. $k = Ae^{-E/RT}$, where T is measured in degrees Kelvin.	**20**	**CO2**

Rate Const	168	354	735	1463	3010	6250
Temp (K)	273	279	285	291	297	303

11	Solve the linear programming problem using simplex method. $\boldsymbol{Minimize}\ Z = x_1 - 3x_2 + 2x_3\ subjected\ to$ $3x_1 - x_2 + 2x_3 \leq 7,$ $-2x_1 + 4x_2 \leq 12,$ $-4x_1 + 3x_2 + 8x_3 \leq 10\ and\ x_1, x_2, x_3 \geq 0$	**20**	**CO2**