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138



National Institute of Technology Hamirpur (H. P.)

B. Tech. (Chemical Engineering) – 7th Semester

End Semester Examination 2022-23

CH-430 Optimization of Chemical Process

Duration: 3 hrs.

Max. Marks: 50

- This question paper consists of five questions and one page.
- Attempt all questions. Make suitable assumptions, if necessary, by clearly stating them.
- Marks will be deducted for omitting steps.

1	Minimize the function using Lagrange multiplier method $\text{minimize } f(x_1, x_2) = 25 + x_1 - 3x_2 + x_1^2 + 2x_2^2 - 5x_1x_2$ $\text{subject to } x_1^2 + x_2^2 = 7$	10
2	Minimize the function using Powell's Conjugate Direction method $\text{minimize } f(x_1, x_2) = 2x_1^3 + 4x_1x_2^3 - 10x_1x_2 + x_2^2$ With starting point $X_0 = \begin{Bmatrix} 5 \\ 2 \end{Bmatrix}$	10
3	Consider the minimization of the function using the Simplex method Maximize $f(x_1, x_2, x_3) = x_1 + 2x_2 + x_3$ Subject to $2x_1 + x_2 - x_3 \leq 2$; $-2x_1 + x_2 - 5x_3 \geq -6$; $4x_1 + x_2 + x_3 \leq 6$; $x_1, x_2, x_3 \geq 0$	10
4	Find the optimum of the following function using Hooke and Jeeves' method $\min f(x) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting point $X^{(1)} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$. Take $\Delta x_1 = \Delta x_2 = 0.8$ and $\epsilon = 0.1$.	10
5	Minimize the function $f(x_1, x_2) = x_1 - x_2 + 3x_1^2 + 2x_1x_2 + x_2^2$. Consider the starting point $X^{(0)} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Marquardt method with $\lambda^0 = 10^4$, $\gamma = 0.25$, $\beta = 2$ and $\epsilon = 10^{-2}$.	10