Name:

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UPES
UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Jan 2021

Course: Chemical Engineering Computing — **Semester:** I
Program: Chemical Engineering: MTech PD — **Time:** 03 hr exam
Course Code: CHPD 7002 — **Max. Marks:** 100
No. of Pages: 2

Instructions: In this Open Book(*S*) and Notes Exam, you are allowed *any number* of books, all handouts provided (including your textbook), your own class notes and solutions to assignment problems, etc. (OBVIOUSLY now)

PLEASE SCAN YOUR ANSWERS AND UPLOAD (WITH CALCULATIONS)

Also, please show all intermediate steps to earn full credit.

SECTION A: (Open Books Exam) (2*30 = 60 Marks) Scan and Upload

Q 1	Consider the following system of equations, (with $\boldsymbol{x} \equiv [x_1, x_2]$) $f_1(x_1, x_2) \equiv 4x_1 + 3x_2 = 6$ (1) $f_2(x_1, x_2) \equiv 2x_1 + x_2 = 5$ (2) subject to the bounds: $0 \le x_1 \le 10, 0 \le x_2 \le 10$ a. Evaluate the ***analytical*** solution to give values of x_1 *and* x_2 (15) b. Write the solution in terms of Cramers' rule (Eqn. 1.4 in the text) in terms of appropriate determinants as: $x_j = \lvert \mathbf{A_j} \rvert / \lvert \mathbf{A} \rvert$; $j = 1, 2$. Here, $\lvert \mathbf{A} \rvert$ is the determinant of matrix, **A**. Obtain the solution using this rule. (15)	***(30 Points)***	**CO1-CO2**
Q. 2	Consider the set of equations in Problem 1. Use the **Gauss Seidel** technique to find the solution given $x_1^{(1)} = -1$ and $x_2^{(1)} = -2$ Do only till: $x_1^{(2)}$ and $x_2^{(2)}$.	***(30 Points)***	**CO3-CO4**

SECTION B: (40 Marks) Scan and Upload			
Q. 3	Consider the following set of two ODE-IVPs [$d\boldsymbol{y}/dt = \boldsymbol{f}(\boldsymbol{y})$]: $\frac{dy_1}{dt} = 2y_1 + 6y_2$ $\frac{dy_2}{dt} = -6y_1 + 5y_2$ (a) Write this equation in terms of the Jacobian, $\boldsymbol{A}$, of $\boldsymbol{f}(\boldsymbol{y})$. (b) Evaluate the eigenvalues of $\boldsymbol{A}$ What can you say about the trajectory (variation with time, t) of the system starting from non-steady state values of $\boldsymbol{y}$.	***(40 Points)***	**CO5**

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