Name: _____ **Roll No:** _____

UPES

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

Program: Chemical Engg. B. Tech. (Refinery and Petrochemicals); CE-RP

Semester: II

Course Name: Process Optimization **Max. Marks: 100**

Course Code: CHCE 3020/CHEG 455 **Duration (*cumulative*): 3 Hrs**

No. of pages: 1 + 2 = 3

In this **OPEN BOOK(S) (any number and kind) and NOTES EXAM**, you are allowed to have any book**s**, ***all*** handouts provided (including your textbook in xeroxed form or in its printed form), ***your own class-notes*** and your solutions to assignment problems, ***etc.*** ***EVERYTHING EXCEPT DISCUSSIONS AMONG YOURSELVES***.

Please REMEMBER to return the Question Paper IF THERE IS ANY WORK DONE ON THAT

1. Show ***ALL intermediate steps*** of your answers (and not just the final answers) to earn marks
2. You are allowed to use only simple scientific calculators
3. ***Please scan YOUR ANSWERS and submit their pdf files on-line on BB to the questions in the sequence of your page numbers: 1, 2, 3. In addition, please submit a copy to me at skgupta@iitk.ac.in*** (This is necessary since come of you may have connectivity issues)

Section A: ALL QUESTIONS ARE COMPULSORY [30 x 2 = 60 Marks]

Q.1 Consider the problem:

$$Minimize\ f(x_1, x_2) \equiv (x_1 - 1)^2 + (x_2 - 1)^2 - 9 = 0$$

subject to the equality constraint:

$$g(x_1, x_2) \equiv x_1 - 4 = 0$$

and bounds

$$-\infty \leq x_1 \leq \infty$$

$$-\infty \leq x_2 \leq \infty$$

Plot $f(x_1, x_2)$ and $g(x_1, x_2)$ and find the solution graphically. (30 Points)

Q. 2 We would like to use the ***binary-coded*** genetic algorithm (GA) with **two** binaries (bits) to represent ***each*** of x_1 and x_2. Use (the conventional) binary number = 0 if $0 \leq R \leq 0.5^{-}$

and binary number = 1 if $0.5^{+} \leq R \leq 1.0$. Use the sequence of random numbers in Table 2.6 on page 78 (or Table 4.1 page 167) of your textbook to fill up the Table (of binaries) below for ***only*** three chromosomes, 1 - 3. ***CO2*** **(*30 points*)**

Chromosomes (binary):

Chromosome No.	x_1 **(binary)**		x_2 **(binary)**	
1				
2				
3				

Section B: COMPULSORY QUESTION[Total 40 Marks]

Q. 1: A doctor in her/his clinic, station 1 (location: x_1, y_1), has to visit ***four*** (*influential*) patients in their homes (stations 2, 3, 4 and 5), with their x, y locations given as x_i, y_i (i = 2, 3, 4, 5), in any *convenient* sequence once her/his clinic is over (say, at 1 pm). (S)He wishes to minimize the total distance (s)he travels. Find the optimal sequence of her/his visits.

(40 Points)

CLINIC, station 1

Patient 1; station 2

Patient 2; station 3

Patient 3; station 4

Patient 4; station 5

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