Name: ______________________________ **Roll No:** --------------------------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, June 2021

Program: Chemical Engg. M. Tech. (spl. PD); CE-PD **Semester: II**
Course Name: Process Simulation and Optimization **Max. Marks: 100**
Course Code: CHPD 7012 **Duration (cumulative): 3 Hrs**
No. of page/s: 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 its pdf files on-line on BB, as well as a copy to me at skgupta@iitk.ac.in to the questions in the sequence of your page numbers: 1, 2, 3***. This is necessary since come of you may have connectivity issues

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

Q.1 Consider the problem:

$$Minimize\ f(x_1, x_2) \equiv (x_1 - 3)^2 + (x_2 - 4)^2 - 9 = 0$$

subject to the equality constraint:

$$g(x_1, x_2) \equiv x_1 - 3 = 0$$

and bounds (first quadrant)

$$0 \le x_1 \le \infty$$
$$0 \le x_2 \le \infty$$

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 **three** binaries (bits) to represent ***each*** of x_1 and x_2. Use (the conventional) binary number = 0 if $0 \le R \le 0.5^-$ and binary number = 1 if $0.5^+ \le R \le 1.0$. 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*** two chromosomes, 1 and 2. ***CO2*** **(*30 points*)**

Chromosomes (binary):

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

Section B: ANSWER ALL [Total 40 Marks]

Q. 1 (***Modified*** Travelling Salesman Problem, in view of the present pandemic of Covid-19): A doctor in his clinic, station 1 (location: x_1, y_1), has to visit ***three*** (influential) patients in their homes, stations 2, 3 and 4, with their x, y locations given as x_i, y_i (i = 2, 3, 4), in any *convenient* sequence once 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**

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