

Name: _____

Roll No: _____



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, June 2021

Program: Chemical Engg. M. Tech. (spl. PD); CE-PD
Course Name: Process Simulation and Optimization
Course Code: CHPD 7012
No. of page/s: 1 + 2 = 3

Semester: II
Max. Marks: 100
Duration (cumulative): 3 Hrs

In this **OPEN BOOK(S) (any number and kind) and NOTES EXAM**, you are allowed to have any books, *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:

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

subject to the equality constraint:

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

and bounds (first quadrant)

$$0 \leq x_1 \leq \infty$$

$$0 \leq x_2 \leq \infty$$

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 **three** 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 two chromosomes, 1 and 2. **CO2 (30 points)**

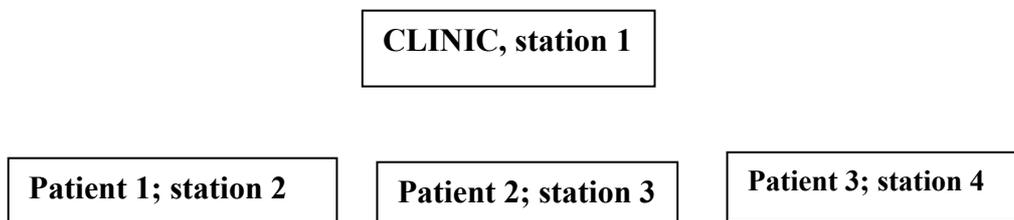
Chromosomes (binary):

Chromosome No.	x_1			x_2		
	(binary)			(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)



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