Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, JUNE 2020

Course: Process Optimization	**Semester:**	**VI**
Program: Chemical Engineering: B.Tech. CERP	**Time:**	**03 hrs.**
Course Code: CHCE 3020/CHEG 455	**Max. Marks:**	**100**
No. of Pages: 1 + 3		

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

PLEASE RETURN THE FILLED TABLES IN PROBLEM 2 OF THIS QUESTION PAPER AND SUBMIT THE SCAN OF *ONLY* THIS PAGE (WITH CALCULATIONS IN YOUR ANSWER SCRIPTS)

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

SECTION A: (Open Books Exam) XXX

S. No.			**CO**
Q	XXX		**CO1**

SECTION B: (Open Books Exam) XXX

Q	XXX		**CO4**

SECTION C: ALL THREE QUESTIONS HERE ARE COMPULSORY [TOTAL: 100 Points)

Q.1 We wish to optimize the following problem using particle swarm optimization (PSO) with ***two*** particles (***SHOW YOUR CALCULATIONS IN YOUR ANSWER SCRIPTS AND SUBMIT ITS SCANNED COPY***): CO3

$$Minimize\ f(x_1, x_2) \equiv (x_1 - 5)^2 + (x_2 - 3)^2$$

subject to the bounds:

$$0 \leq x_1 \leq 9$$

$$0 \leq x_2 \leq 9$$

Continued…

(a) Fill up Table 1.

Table 1: Initial, (0)th, solutions

Particle No., j	$\boldsymbol{x_{1,j}^{(0)}}$	$\boldsymbol{x_{2,j}^{(0)}}$	$\boldsymbol{I_j^{(0)}}$
1			
2			

(07)

b) Use each of the initial velocities, $V_{i,j}^{(0)}$, as 0. Fill up Table 2 below (using ***constant*** values of w = 0.6, $k_1 = k_2$ = 5) [some values may need to be copied from Table 1]. Random numbers with a seed of 0.88876 are provided IN THE TEXT

(08)

Table 2:

Part. No., j	$\boldsymbol{V_{1,j}^{0}}$	$\boldsymbol{V_{2,j}^{0}}$	$\boldsymbol{x_{1,j}^{0}}$	$\boldsymbol{x_{2,j}^{0}}$	I_j^0	$Pbest_{1,j}^0$	$Pbest_{2,j}^0$	$Gbest_{1,j}^0$	$Gbest_{2,j}^0$
1	0	0							
2	0	0							

(15) (**30** ***Points***)

Q. 2 Consider the (same) function, $f(x_1, x_2)$, to be minimized: CO3

$$Minimize\ f(x_1, x_2) \equiv (x_1 - 5)^2 + (x_2 - 3)^2$$

subject to the bounds:

$$0 \leq x_1 \leq 9$$

$$0 \leq x_2 \leq 9$$

We wish to use ***Simulated Annealing*** to solve this problem.

(a) Write the expression (with numbers substituted) between u_i and x_i (5)

(b) Generate an initial point, u_j^0, j = 1, 2 (5)

(c) Convert to x_j^0, j = 1, 2 (5)

(d) Evaluate the corresponding objective function, f^0. (5)

(e) Using s_j^0= 0.5, j = 1, 2, evaluate the next set of values, u_j^1, j = 1, 2 and x_j^1, j = 1, 2

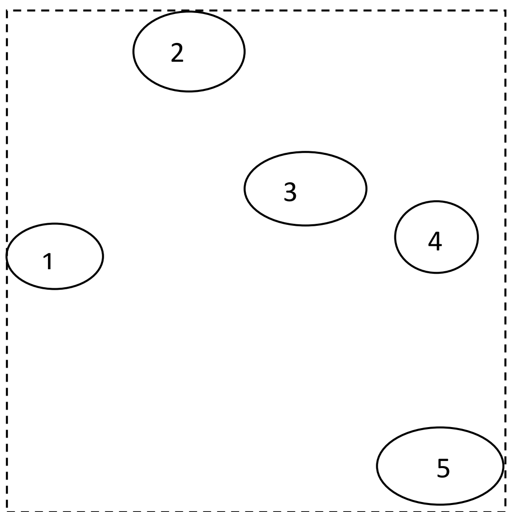
(5)

(f) Find f^1 (2)

(g) Using T = 30, find out if this new point is to be accepted or not. (3)

(**30 *Points***)

Q. 3 We would like to solve a modified TSP (Travelling Salesman) problem discussed in the (BB) Lecture, with Headquarter as Node 1, and four *additional* nodes/shops numbered 2, 3, 4 and 5, as shown in the diagram below, using **Single-Objective BINARY-CODED GA.** CO3, 5



Develop the algorithm you would use to minimize the total distance covered by the salesman from Node 1 and back to node 1 but with and ***additional*** step that the salesman has to get back to node 1 after every node which is an even number (to pick up material at the headquarters, point 1, as well as to report to the headquarters of what has happened at the last few nodes). The coordinates, x_i, y_i, are given for each node and the distance between the i^{th} and j^{th} nodes is d_{ij}. (***40 Points***)

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