

Name: _____

Enrollment No: -----

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Course: Process Optimization (Elective)

Semester: VI

Program: B. Tech. Chemical Engg. (spl. RP); CE-RP

Time: 3 Hrs

Course Code: CHEG 455 (Elective)

Max. Marks: 100

No. of pages: 0 + 3

INSTRUCTIONS: In this OPEN BOOK(S) (any number of books and kind) and NOTES EXAM, you are allowed to have any books, *all* handouts provided (including your textbook in xeroxed form), *your own class-notes* and your solutions to assignment problems, *etc.*

1. Show all *intermediate steps* of your answers (and not just the final answers) to earn marks
 2. *Please answer the questions in the sequence: 1, 2, 3.* You can do this by assigning, *a priori*, a few pages to each question, in the correct sequence. You may then answer the questions in whatever sequence you wish to, *all parts in one place*
 3. No student is allowed to leave the examination hall in the first hour of the exam
-

Section A: XXX

No questions here (open books exam)

Section B: XXX

No questions here (open books exam)

Section C: ALL THREE QUESTIONS ARE COMPULSORY [Total 100 Marks]

- Q.1 Find the optimum value of the radius, r , and height, h , of a cylinder (as shown in the diagram on the next page) which can be fully inscribed within a sphere of radius, 10 m. The optimum cylinder should have the maximum volume.

..... Continued

Cylinder
(shaded)

(30 Points)

Q. 2 We wish to minimize

$$\text{Min } f(x_1, x_2) \equiv (x_1 - 2)^2 + (x_2 - 1)^2$$

with the *equality* constraint

$$g_1(x_1, x_2, x_3) \equiv x_1 + x_2 - x_3^2 - 3 = 0$$

Use the penalty function technique with ν as the penalty parameter to

(a) write the expression for the function, F , incorporating the constraint (5)

(b) deduce *all* the equations for optimality (12)

(c) solve these equations taking $x_3 = 0$ (this leaves only three equations in three variables)

(8)

(d) Solve these equations to give x_1 and x_2

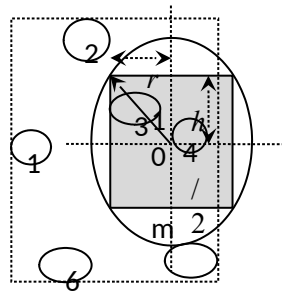
(e) Can you get a value of ν (5)

(30 points)

Continued...

Q. 3 (Open-ended Problem again, possibly with several solutions)

We would like to solve the TSP (Travelling Salesman Problem) discussed in the Lecture using GA (and in Chapter 5 of the book), with Headquarter as Node 1, and five additional nodes/shops numbered 2, 3, 4, 5 and 6, as shown in the diagram below, using **Single-Objective Simulated Annealing (SSA)**.



5

Develop the algorithm you would use to minimize the total distance covered by the salesman from Node 1 and back to node 1 with the standard assumptions of the TSP. The coordinates, x_i, y_i , are given for each node.

(40 Points)

* * *

