

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – WINTER • 2014

Subject code: 733001

Date: 25-11-2014

Subject Name: Advance Process Optimization

Time: 02:30 pm - 05:00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- (a) List out candidate locations for optimum of a single variable optimization problem and discuss necessary and sufficient conditions for an extremum of an unconstrained single variable function. 0
7
- (b) A log has the form of a frustum of cone 30 feet long, the diameters of its ends being 2 feet and 1 foot. A beam of square section is to be cut from the log. Find the length if the volume is maximum. 0
7
- Q.2**
- (a) We want to apply the region elimination search techniques to reduce the interval of uncertainty for maximum value of the function $f(x) = 9.21 + 3.7x - 2x^3$ from $[0,1]$ to less than one percent of its original size. Compare performance of different region elimination methods for that calculation. 0
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- (b) Define a suitable search region and a feasible initial base point for the complex method of search in minimizing $y = 5x_1^3 - 3x_1^2x_2 + x_2^2$ subject to the restrictions that 0
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- $$3 + 2x_1 - 3x_2 \leq 0$$
- $$(x_1 - 1)^2 + (x_2 - 2)^2 \leq 4$$
- Setup a complex method of search and carryout two cycles of search.
- OR**
- (b) Explain multi-objective optimization with example and discuss the concept of non- dominated solutions and pareto front. 0

- Q.3 (a)** A complete stage of the Rosenbrock method gives the following results in the search for a minimum: 7
0
7

x_1	x_2	y	Result		d_1	d_2	s_1	s_2
			ξ_1	ξ_2				
3	7	55			0	0	$\sqrt{2}$	$\sqrt{2}$
4	8	103	Failure		0	0	$-1/\sqrt{2}$	$\sqrt{2}$
2	8	38		Success	0	$\sqrt{2}$	$-1/\sqrt{2}$	$3\sqrt{2}$
1.5	7.5	29	Success		$-1/\sqrt{2}$	$\sqrt{2}$	$-3/\sqrt{2}$	$3\sqrt{2}$
-1.5	10.5	35		Failure	$-1/\sqrt{2}$	$\sqrt{2}$	$-3/\sqrt{2}$	$-3/\sqrt{2}$

- Determine the directions used in this stage of search.
 - Check the last two rows of the table and correct it if there are any mistakes.
 - Find out directions to be used in next stage search.
- (b)** Using the method of penalty function find the minimum of 0
7
 $y = 4x_1^2 + 5x_2^2$ subject to $2x_1 + 3x_2 = 6$.

OR

- Q.3 (a)** Explain successive quadratic programming for optimization in chemical engineering with example. 0
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- (b)** Discuss the role of ANN in optimization giving examples. Discuss important step in developing model using ANN and highlight limitations of it. 0
7

- Q.4 (a)** Broadly explain different steps in GA and discuss role of cross over, mutation and fitness selection. 0
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- (b)** List out methods to solve Integer and mixed integer programming discussing strength and weakness. 0
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OR

- Q.4 (a)** Search for minimum of the objective function $y = x_1^2 + 3x_2^2 + 5x_3^2$, starting from the base point (2, -1, 1). 0
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- (b) Minimize Rosenbrock function $f(x) = 25(x_2 - x_1^2)^2 + (1 - x_1^2)$ with an initial point of (5, 2) using Hooke-Jeeves method. 0
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- Q.5** (a) Find the dual of $y = \frac{4}{t_1 t_2} + \frac{3}{t_2^2} + 4t_1 t_2^2$ and solve both primal and dual problems with $t_i \geq 0$. 0
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- (b) Minimize $f(x) = x_1^2 + \exp(x_1^2 + x_2^2)$, starting at the point (2, 2), using Powell's method. 0
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- OR**
- Q.5** (a) Discuss optimization of liquid-liquid extraction operation giving real/practical examples. 0
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- (b) Explain Ant colony optimization technique with algorithm and example. 0
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