Code No: 5221AK **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech I Semester Examinations, February - 2017

ADVANCED OPTIMIZATION TECHNIQUES AND APPLICATIONS

(Thermal Engineering)

Time: 3hrs **Max.Marks:75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

5 × 5 Marks = 25

1.a) In Golden section method, prove that distance at which two experiments are conducted from either ends of given interval uncertainity is 0.3820 × length of that interval of uncertainty. [5]

b) How the search direction is changed from one cycle to its next cycle if it is needed. [5]

c) Write a procedure for writing a dual problem for a typical constrained GP. [5]

d) State the advantages and disadvantages of simulation. [5]

e) Consider a typical stochastic linear programing problem, explain the procedure to write its equivalent deterministic linear programming problem. [5]

PART - B

5 × 10 Marks = 50

2.a) Find the minimum of $f(x) = x^2 - 2x$ by using the Fibonacci method. Take initial interval of uncertainty. Reduce the initial interval of uncertainty to its 10%.

b) State the problem of locating the last experiment in the Fibonacci method. [5+5]

OR

3. Min Y= 25600 x^4 +16x^2- 8x+1 using Quadratic interpolation method. Take step size as 0.1. Show calculations only for two cycles. [10]

4.a) Minimize $f(x) = x_1^2 + x_2^2 + 2x_1^2 - 16x_1 - 12x_2$ by using univariant method. Take initial solution as [0,0]. Show calculations only for two cycles.

b) State the limitations of univariant method. How are they resolved. [5+5]

OR

5.a) Define gradient of function. Explain its characteristics.

b) Solve the following problem by steepest descent method

$Min\ y = 10 - x_1 + x_1 x_2 + x_2^2$. Take a starting point as (1, 1). [5+5]

6.a) State the arithmetic-geometric inequality theorem. Using it derive the dual problem for unconstrained Geometric programming problem.

b) Design an oil storage tank (rectangular) for the minimum cost. The materials for the bottom , side and ends cost C_1, C_2 and C_3 units per sq.m respectively. It costs C_4 for each trip of transportation of V volume of material. [5+5]

OR

7.a) Explain the Bellman's principle of optimality.
b) Solve the following LPP by dynamic programming approach [5+5]

$$Max\ Z = 35x_1 + 25x_2$$
$$st\ 4x_1 + 8x_2 \leq 24$$
$$15x_1 + 5x_2 \leq 40,\ x_i \geq 0 \forall i$$

8. Solve the following Linear Programming Problem (LPP) and find the effect of change in constraint constants to [5, 6 ,4]

$Max\ Z = 4x_1 + 6x_2 + 2x_3 \quad st$

$4x_1 - 4x_2 \leq 5, -x_1 + 6x_2 \leq 5, -x_1 + x_2 + x_3 \leq 5,$

$x_i \geq 0$ [10]

OR

9. A company manufactures maximum 204 motor cycles per day. However depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 motor cycles to 204 motor cycles whose probability distribution is as given below:

Production per day	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The motor cycles are transported in a specially designed three storied lorry that can accommodate only 200 motor cycles. Use the following random numbers:82,89,78,24,52,53,61,18,45,04,23,50,77,27,54,10, simulate the process for 15 days to estimate out

a) The average number of motor cycles waiting in the factory.
b) The average number of empty spaces on the lorry. [10]

10. $Max \quad Z = x_1 + 4x_2$

$subject\ to\ 2x_1 + 4x_2 \leq 7,$

$5x_1 + 6x_2 \leq 15,\ x_i \geq 0 \forall i\ and$

Integers. Solve it by Gomory cutting plane algorithm. [10]

OR

11.a) Mass-produced items always show random variation in their dimensions due to small unpredictable and uncontrollable disturbing influences . Suppose that the diameter X of the bolts manufactured in a production shop follow the distribution.

$$f_X(x) = a(x-0.9)(1.1-x)\ for\ 0.9 \leq x \leq 1.1$$
$$= 0 \quad otherwise$$

Find the values of a, μ_X and $\sigma_X{}^2$

b) Explain about chance constrained algorithm. [5+5]

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