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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, APR-MAY 2018

Mechanical Engineering

(Machine Design)

01ME6122 Optimization Techniques for Engineering

Max. Marks: 60 Duration: 3 Hours

Instructions: For search methods wherever applicable, conduct ***three*** iterations for single variable and ***two*** iterations for multi variable optimization.

Answer ANY TWO questions from each part.

PART-A

1. Find the extremum of the function $f(x_1, x_2) = 16x_1 + 12x_2 + x_1^2 + x_2^2$ and state weather this point is maximum, minimum or saddle point.

(9 marks)

2. a) Discuss convex set with an example.

(3 marks)

b) Comment on the definiteness and convexity of the following function:

$$f(x_1, x_2) = 2x_1^2 - 3x_1x_2 + 2x_2^2$$

(6 marks)

3. Minimize $f(x_1, x_2) = 4x_1^2 + 5x_2^2$ subject to $2x_1 + 3x_2 - 6 = 0$ using Lagrangian multipliers.

(9 marks)

PART-B

4. a) State the rules for region elimination in single variable optimization.

(3 marks)

b) Minimize $f(x) = 10 + x^3 - 2x - 5\exp(x)$ in the interval (-5, 5) using golden section method.

(6 marks)

5. a) State advantages and limitations of gradient based methods.

(3marks)

b) Minimize $f(x) = \exp(x) - x^3$ in the interval (-2, 5) using secant method.

(6 marks)

6. Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $X^{(0)} = \binom{0}{0}$ using conjugate gradient method

(9 marks)

PART-C

7. a) Minimize $f(x_1, x_2) = x_1^2 + x_2^2 + 60x_1$ subject to the constraints

$$g_1 = x_1 - 80 \geq 0$$

$$g_2 = x_1 + x_2 - 120 \geq 0$$

using Kuhn-Tucker conditions.

(9 marks)

b) What are the limitations of Kuhn-Tucker theorem?

(3 marks)

8. a) What do you mean by barrier function?

(3 marks)

b) Minimize $f(x_1, x_2) = (x_1 - 1)^2 + (x_2 - 2)^2$ subj. to $g(x_1, x_2) = x_1 + x_2 - 4 \geq 0$ using penalty function method. Use logarithmic penalty function.

(9 marks)

9. a) State and explain Bellman's theorem in dynamic programming.

(3 marks)

b) Discuss forward and backward recursion in dyn. programming with suitable equations.

(9 marks)