Printed Pages—3 **EME023**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2534 **Roll No.** | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION 2010-11

OPTIMIZATION TECHNIQUES IN ENGINEERING

Time : 2 Hours *Total Marks : 50*

Note : (1) Attempt **all** questions.

(2) Attempt **all** parts of **first** question and **two** parts from each remaining **three** questions.

(3) First question carries **14** marks while remaining three questions carry **12** marks each.

(4) Assume suitable data missing if any.

1. (a) Differentrate between Convex polyhedron and polytope.

(b) What is the significance of Lagrange multipliers ?

(c) Define a saddle point and indicate its significance.

(d) What do you understand by nonlinear least square optimization problem ?

(e) What is an active constraint ?

(f) Compare between Euler and modified Euler method.

(g) Define the correlation coefficient. **(2×7=14)**

2. (a) Locate and classify the stationary points of the following function :

$f(x_1, x_2) = x_1^2 + 2x_1x_2 + 2x_2^2 - 2x_1 + x_2 + 8$

(b) Determine whether the following functions are convex or concave.

$f(x_1,x_2,x_3) = 4x_1^2 + 3x_2^2 + 5x_3^2 + 6x_1x_2 + x_1x_3 - 3x_1 - 2x_2 + 15$

(c) Consider the following problem :

Minimize $f = x_1^2 + x_2^2 + x_3^2$

subject to

$x_1 + x_2 + x_3 \geq 5$

$2 - x_2x_3 \leq 0$

$x_1 \geq 0, x_2 \geq 0, x_3 \geq 2$

Determine whether the Kuhn-Tucker conditions are satisfied at the following points : $x_1 = 2, x_2 = 1, x_3 = 2$.

(2×6=12)

3. (a) Write the steps in Genetic Algorithm.

(b) Find whether the given direction $s = (1,1)^T$ at the point $(2,3)^T$ is descent for the function $f(x_1, x_2) = 2x_1^2 + x_2^2 - 2x_1x_2 + 4$. Compare it with the direction $-\nabla f$ at $x = (2, 3)^T$.

(c) Describe the Euler method to solve an initial value problem.

(2×6=12)

4. (a) The width of a slot on a duralium forging is normally distributed. The specifications of the slot width is 0.900 ± 0.005. The parameters $\mu = 0.9$ and $\sigma = 0.003$ are known from past experience in production process. What is the percent of Scrap forging ?

(b) Explain the cutting plane method used in integer programming problem. Give an example.

(c) Using Simplex algorithm solve the following problem : maximize $f = y_1 + 2y_2$ subject to $3y_1 + 2y_2 \leq 12$, $2y_1 + 3y_2 \geq 6$, $y_1 \geq 0$, y_2 is unrestricted in sign. **(2×6=12)**