

**B.Tech. - VIEP - MECHANICAL ENGINEERING
(BTMEVI)**

Term-End Examination

00286

June, 2015

**BIMEE-022 : OPTIMIZATION FOR ENGINEERING
DESIGN**

Time : 3 hours

Maximum Marks : 70

Note : Answer any five questions. Assume any suitable data, if missing. Each question carries equal marks. Use of scientific calculator is allowed.

1. (a) Explain how and why optimization techniques have been valuable in aiding executive decisions. 7
- (b) Discuss the various phases in solving an optimization problem. 7
2. (a) With the help of a suitable example, explain the role of differential calculus in solving optimization problem. 7
- (b) Differentiate between single and multi-variable optimization giving suitable example. 7

3. (a) For each of the following functions determine whether it is convex, concave or neither : 7

(i) $f(x) = x_1 x_2 - x_1^2 - x_2^2$

(ii) $f(x) = 20x_1 + 10x_2$

- (b) Solve the following LP problem graphically : 7

Maximise $z = -x_1 + 2x_2$

subject to :

$$x_1 - x_2 \leq -1$$

$$-0.5x_1 + x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

4. Solve the following LP problem using simplex method : 14

Maximize $z = 3x_1 + 2x_2 + 5x_3$

subject to :

$$x_1 + x_2 + x_3 \leq 9$$

$$2x_1 + 3x_2 + 5x_3 \leq 30$$

$$2x_1 - x_2 - x_3 \leq 8$$

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

5. (a) Explain the concept involved in the Gomory's cutting plane method. 7

(b) Explain the graphical method for solving linear goal programming problem. 7

6. Use the method of Lagrangian multipliers to solve the following non-linear programming problem. Does the solution maximize or minimize the objective function? 14

$$\text{Optimize } z = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$$

$$\text{subject to : } x_1 + x_2 + x_3 = 20$$

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

7. Write short notes on any *two* of the following :

$$2 \times 7 = 14$$

(a) One-dimensional optimization

(b) Dual linear programming problem

(c) Genetic Algorithm