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BIMEE-022

B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

December, 2015

BIMEE-022 : OPTIMIZATION FOR ENGINEERING DESIGN

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Explain the role of optimization techniques in engineering and business. 7

(b) What do you understand by deterministic and probabilistic models that are used in optimization methods ? 7

2. (a) With the help of a suitable example, explain the procedure of constrained optimization. 7

(b) With the help of a suitable example, explain the procedure for solving a multi-variable optimization problem. 7

3. (a) Consider the following function :

$$f(x) = 2x_1^2 - 24x_1 + 2x_2^2 - 8x_2 + 2x_3^2 - 12x_3 + 200$$

By separating this function into three one-variable functions, show that the function is convex. Solve the problem by solving each one-variable function by calculus. 7

(b) Solve the following LP problem by graphical method : 7

Maximise $z = -x_1 + 4x_2$

subject to

$$-3x_1 + x_2 \leq 6$$

$$x_1 + 2x_2 \leq 4$$

$$x_2 \leq -3$$

4. Using Big M-method, solve the following LP problem : 14

Minimize $z = 12x_1 + 20x_2$

subject to

$$6x_1 + 8x_2 \geq 100$$

$$7x_1 + 12x_2 \geq 120$$

$$x_1, x_2 \geq 0$$

5. (a) Explain the concept involved in branch and bound algorithm used for solving integer programming problem. 7

(b) Discuss the concept of Genetic algorithm optimization. 7

6. (a) Using the method of Lagrangian multipliers, solve the following optimization problem : 7

Optimize $z = x_1^2 - 10x_1 + x_2^2 - 6x_2 + x_3^2 - 4x_3$

subject to

$$x_1 + x_2 + x_3 = 7$$

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

(b) Solve the following problem using the Kuhn-Tucker conditions : 7

Maximize $z = 2x_1^2 - 7x_2^2 + 12x_1x_2$

subject to

$$2x_1 + 5x_2 \leq 98$$

$$x_1, x_2 \geq 0$$

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

(a) Non-traditional algorithms

(b) Geometric programming

(c) Optimization techniques as tools for decision-making