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BIMEE-004

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

00026

Term-End Examination

June, 2015

BIMEE-004 : OPTIMIZATION TECHNIQUES IN ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** of the following questions. All questions carry equal marks. Assume a suitable value for any missing/incorrect data. Use of scientific calculator is permitted.*

1. (a) Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius. 7

(b) Determine the maximum value of a two variable function as given below :

$$f(x) = 2x_1 x_2 + 2x_2 - x_1^2 - 2x_2^2$$ 7

2. A production manager is faced with the problem of job allocation of his two production teams. The production rate of Team I is 8 units per hour, while the production rate of Team II is 5 units per hour. The normal working hours of each team is 40 hours per week. The production manager has prioritized the following goals for the coming week.

P_1 = Avoid under-achievement of the desired production level of 550 units.

P_2 = Overtime operation of Team I is limited to 5 hours.

P_3 = The total overtime for both the teams should be minimized.

P_4 = Any under-utilization of regular working hours of the teams should be avoided; assign differential weights according to the relative productivity of the two teams.

Develop the above goal programming problem and solve it. *14*

3. (a) Discuss the two phase method for solving an LPP. 7

(b) Explain the methodology of Gauss-Newton method for solving an optimization problem. 7

4. Solve the following assignment problem to maximize the profit. The following table gives the profits of assignment in INR. Also give the optimal profit : 14

	J_1	J_2	J_3	J_4	J_5
M_1	50	60	40	30	35
M_2	35	55	45	55	40
M_3	40	45	50	35	35
M_4	60	40	55	40	30
M_5	45	35	45	55	50

5. (a) State the necessary and sufficient condition for the maximum of a multi-variable function. 7

(b) Solve the following LPP by the cutting plane method : 7

Max $z = 200\, y_1 + 400\, y_2 + 440\, y_3$

subject to $15\, y_1 + 30\, y_2 + 20\, y_3 \leq 600$

$15\, y_1 + 10\, y_2 + 50\, y_3 \leq 400$

6. (a) Define Dual of an LPP. Also illustrate with the help of a suitable example. 7

(b) Discuss the Quasi-Newton methods. 7

7. Write short notes on any ***two*** of the following : *2×7=14*

(a) Dichotomous Search Method

(b) Regula Falsi Method

(c) Genetic Algorithm

(d) Simulated Annealing