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BIMEE-004

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

Term-End Examination

01906

June, 2016

BIMEE-004 : OPTIMIZATION TECHNIQUES IN ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) What is decision-making ? Explain and differentiate this under the conditions of certainty and uncertainty.

(b) A company produces two products 'A' and 'B', and has a total production capacity of 9 units per day, 'A' and 'B' both requiring the same production capacity. The company has a permanent contract with another company to supply 2 units of 'A' and at least 3 units of 'B' per day. Each unit of 'A' requires 20 machine hours production time and each unit of 'B' requires 50 machine hours of production time. The daily maximum possible number of machine hours is 360. The company makes a profit of ₹ 800 per unit of 'A' and ₹ 1,200 per unit of 'B'. Determine the production schedule for maximum profit. 7+7

2. (a) In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails, and loses $\frac{1}{2}$ unit of value when there are one head and one tail. Determine the pay-off matrix, the best strategies for each player and the value of the game to A.

(b) State the necessary and sufficient conditions for the maximum of a multi-variable function. 7+7

3. (a) Explain the methods used in solving integer programming problems.

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

Maximize $z = -2x_1 - 6x_2$

subject to :

$-x_1 + x_2 \geq 0$

$x_1^2 + x_2^2 \geq 4$

$x_1, x_2 \geq 0$ 7+7

4. (a) Solve the following equations by Jacobi's iteration method :

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

(b) By using Modified Euler's method, determine the value of y when

$x = 0{\cdot}1$ given that :

$$y(0) = 1, \text{ and } \frac{dy}{dx} = x^2 + y.$$

(Take $h = 0{\cdot}05$) 7+7

5. (a) Apply Runge-Kutta method to find an approximate value of y for $x = 0{\cdot}2$ in steps of $0{\cdot}1$, if $\frac{dy}{dx} = x + y^2$,

given that :

$$y = 1 \text{ when } x = 0.$$

(b) Evaluate $\int_0^6 \frac{1}{1+x^2}\,dx$, using Simpson's $\frac{1}{3}$rd rule. 7+7

6. (a) A production control superintendent finds the following information on his desk. In departments A, B and C the number of surplus pallets is 18, 27 and 21 respectively. In departments G, H, I and J, the number of pallets required is 14, 12, 23 and 17 respectively. The time in minutes to move a pallet from one department to another is given below :

From \ To	G	H	I	J
A	13	25	12	21
B	18	23	14	9
C	23	15	12	16

What is the optimal distribution plan to minimize the moving time ?

(b) Solve the following linear programming problem :

Maximize $z = 2x_1 + x_2$

subject to :

$$x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2$$

$$x_1 - 2x_2 \leq 1$$

$$x_1, x_2 \geq 0.$$

7+7

7. (a) What is the need of dynamic programming and how is it different from linear programming ? State some applications of dynamic programming.

(b) List down

(i) the advantages,

(ii) the applications, and

(iii) the limitations

of simulation.

7+7
