C 56256-A (Pages : 3) Name.....

Reg. No.....

EIGHTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION

JUNE 2009

ME 04 805 (A)—OPTIMIZATION TECHNIQUES

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

I. (a) Differentiate between feasible solution and basic feasible solution in LPP.

(b) Explain the steps of formulating an optimisation problem.

(c) Write the linear programming form of the transportation model.

(d) How do you resolve degeneracy in transportation problem ?

(e) Write the significance of restricted basis method of simplex algorithm.

(f) What is bordered Hessian Matrix ? Explain with an example.

(g) Explain pure and mixed strategies in game theory.

(h) Consider a cable of length 'K' units. The objective is to subdivide this cable into 'n' parts each having a length Pi, where i varies from 1 to n such that the product of the length of the parts is minimised. Solve the problem using dynamic programming approach.

(8 × 5 = 40 marks)

Part B

II. (a) Solve the following LP problem by simplex method :

$$\text{Maximise } Z = 4x_1 + 10x_2$$

$$\text{subject to } 2x_1 + x_2 \leq 10$$
$$2x_1 + 5x_2 \leq 20$$
$$2x_1 + 3x_2 \leq 18$$
$$x_1, x_2 \geq 0.$$

(i) Indicate that this problem has an alternate optimal basic feasible solution.

(ii) Find the optimal solution.

(iii) Hence show that this problem has multiple optimal solution.

(b) Solve the following problem using dual simplex method :

$$\text{Minimise } Z = x_1 + 2x_2 + 3x_3$$

$$\text{subject to } 2x_1 + x_2 + x_3 \geq 4$$
$$x_1 + x_2 + 2x_3 \leq 8$$
$$x_2 - x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

Turn over

III. (a) A manufacturer must produce a product in sufficient quantity to meet contracted sales in the next four months. The production facilities available for this product are limited but by different amounts in respective months. The unit cost of production also varies in each month.

The product may be produced in one month and then held for sale in a later month but at an estimated storage cost of Re. 1 per unit per month. No storage cost is incurred for goods sold in the same month in which they are produced. There is no initial inventory and none is desired at the end of four months. Given the following table, show that how much to produce in each month in order to minimise total costs. Solve as a transportation problem.

Months	*Contracted sales (Units)*	*Maximum Production*	*Unit cost of production*
1	20	40	14
2	30	50	16
3	50	30	15
4	40	50	17

(b) A firm produces four products : There are four operators capable of producing any of these four products. The firm records 8 hours a day and allows 30 minutes for lunch. The processing time in minutes and the profit for each of the products are given below :

		Products			
		A	B	C	D
Operator	1	15	9	10	6
	2	10	6	9	6
	3	25	15	15	9
	4	15	9	10	10
Profit (Rs.) per unit		8	6	5	4

IV. (a) The relationship between sales S and the amounts x and y spent on two advertising media is given by :

$$S = \frac{200x}{(5+x)} + \frac{100y}{(10+y)}.$$

The net profit is $\frac{1}{5}$ of the sales minus the cost of advertising. The advertising budget has a maximum of 20 monetary units. Determine how it should be allocated between the two media to maximise the net profit, using Kuhn-Tucker conditions.

(b) Use Wolf's method for solving the following Quadratic Programming Problems :

$$\text{Maximise : } Z = 1.8x_1 + 3x_2 - 0.001x_1^2 - 0.005x_2^2 - 100$$

$$\text{subject to } 2x_1 + 3x_2 \leq 2500$$
$$x_1 + 2x_2 \leq 1500$$
$$x_1, x_2 \geq 0$$

V. (a) Solve the following game :

		B				
		1	2	3	4	5
A	1	2	4	3	8	4
	2	5	6	3	7	8
	3	6	7	9	8	7
	4	4	2	8	4	3

(b) An electronic device consists of four components, each of which must function for the system to function. A system reliability can be improved by installing parallel units in one or more of the components. The reliability (R) of a component with one, two or three parallel units and the corresponding cost (C) are given in the following table. The maximum amount available for this device is 100. The problem is to determine the number of parallel units in each component.

Number of units	*Components*							
	1		2		3		4	
	R	C	R	C	R	C	R	C
1	0.7	10	0.5	20	0.7	10	0.6	20
2	0.8	20	0.7	40	0.9	30	0.7	30
3	0.9	30	0.8	50	0.95	40	0.9	40

[4 × 15 = 60 marks]