Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 710904N **Date: 15/02/2012**
Subject Name: Optimization Techniques
Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** In the context of Linear Programming, explain the meaning and significance of sensitivity analysis with the help of suitable examples **07**

(b) A manufacturer produces three machine parts A, B, and C. The raw material costs of parts A, B and C are Rs 250, Rs 500, and Rs 750 per unit, and the corresponding prices for finished parts are Rs 2500, Rs 3750 and Rs 5000 per unit, respectively. Part A requires turning and drilling operations, while part B needs milling and drilling operations. Part C requires turning and milling operations. The number of parts that can be produced on various machines per day and the daily cost of running the machines are given below. Formulate the problem to maximize profit. **07**

Machine part	Number of parts that can be produced on		
	Lathe	Drilling	Milling
A	15	15	-
B	-	20	30
C	25	-	10
Cost of running the machine per day	Rs 12500	Rs 10000	Rs 15000

Q.2 **(a)** Solve by Simplex method. **07**

Maximize $z = x1 + 2x2 + x3$

Subjected to $2x1 + x2 - x3 \leq 2$

$-2x1 + x2 - 5x3 \geq -6$

$4x1 + x2 + x3 \leq 6$

$x1, x2, x3 \geq 0$

Also write down the Dual of this problem

(b) State the necessary and sufficient conditions for the maximization of a multivariable function f(x) **07**

OR

(b) (i) Find the minimum or maximum, if any, for the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ **07**

(ii) The horse power generated by the Pelton turbine is proportional to u(V – u); where 'u' is the velocity of the wheel, which is a variable, and 'V' is the velocity of the jet, which is fixed. Show that the efficiency of the Pelton turbine will be maximum when u = V/2

Q.3 **(a)** A rectangular beam is to be cut from a circular log of radius 'r'. Find the cross-sectional dimensions of the beam to (a) maximize the cross-sectional area of the beam, and (b) maximize the perimeter of the beam section **07**

(b) Using Lagrange multiplier method, find the dimensions of a closed cylindrical soft drink can that can hold soft drink of volume V for which the surface area (including the top and bottom) is a minimum. **07**

OR

Q.3 **(a)** A departmental store plans to construct a one-storey building with a rectangular platform. The building is required to have a floor area of 22,500 ft^2 and a height of 18 ft. It is proposed to use brick walls on three sides and a glass wall on the fourth side. Find the dimension of the building to minimize the cost of construction of the walls and the roof assuming that the glass wall costs twice as much as that of the brick wall and the roof costs three times as much as that of the brick wall per unit area. **07**

(b) Show that the right circular cylinder of a given surface (including the ends) and a maximum volume is such that its height is equal to the diameter of the base. Use Lagrange multiplier method. **07**

Q.4 **(a)** Two products, A and B, are to be manufactured utilizing time in a manufacturing department and an assembly department. The normal production time available in these departments is 40 hours per week. One hour is required in the manufacturing department to produce one unit of product A, whereas 2 hours are required to produce one unit of product B. Products A and B requires 1.5 hours in the assembly department. The profit per unit of product A is 80 and that of B is 100. Formulate the problem as a single goal model and write down the initial simplex tableau. **07**

(b) Solve following LP model using cutting plane method **07**

Maximize $z = 4x1 + 8x2$

Subject to $4x1 + 5x2 \leq 40$

$x1 + 2x2 \leq 12$

$x1, x2 \geq 0$; integers.

OR

Q.4 **(a)** With the help of suitable example explain (i) single goal model (ii) multiple goal model **07**

(b) Solve following LP model using branch & bound method **07**

Maximize $z = 4x1 + 8x2$

Subject to $4x1 + 5x2 \leq 40$

$x1 + 2x2 \leq 12$

$x1, x2 \geq 0$; integers.

Q.5 **(a)** Explain, with the help of suitable examples, (i) mini-max & max-mini principle, (ii) saddle point (iii) dominance in games **07**

(b) For the pay-off matrix given below, find the value of the game **07**

$$\begin{array}{cc} & \text{Player B} \\ \text{Player A} & \begin{bmatrix} 1 & 2 & 1 \\ 0 & -4 & -1 \\ 1 & 3 & -2 \end{bmatrix} \end{array}$$

OR

Q.5 **(a)** In the context of dynamic programming explain the forward procedure and the backward procedure **07**

(b) A manufacturing company has 3 sections producing auto parts, bicycle parts and sewing machine parts respectively. The management has allocated Rs 20,000 for expanding the production facilities. In the auto parts and bicycle parts sections, the production can be increased either by adding new machines or by replacing some old inefficient machines by automatic machines. The sewing machine parts section was started only a few years back and thus the additional amount can be invested only by adding new machines to the section. The cost of adding and replacing the machines, along with the associated expected returns in the different sections is given below. Select a set of expansion plans which may yield the maximum return. **07**

Alternatives	Auto parts section		Bicycle parts section		Sewing machine parts section	
	Cost	Return	Cost	Return	Cost	Return
No expansion	0	0	0	0	0	0
Add new machines	4000	8000	8000	12000	2000	8000
Replace old machines	6000	10000	12000	18000	-	-

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