

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2013****Subject code: 710904N****Date: 06-06-2013****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) A television manufacturing company has to decide on the number of 27 inch and 20 inch sets to be produced at one of its factories. Market research indicates that at most 40 of the 27 inch and 10 of the 20 inch sets can be sold per month. The maximum number of work hours available is 500 per month. A 27 inch set requires 20 work hours and a 20 inch set requires 10 work hours. Each 27 inch sold produces a profit of Rs 6000 and each 20 inch produces a profit of Rs 4000. A wholesaler has agreed to purchase all the television sets produced if the numbers do not exceed the maximum indicated by the market research. Formulate a LP model for this problem and solve this model graphically **07**

- (b) A farmer can plant up to 8 acres of land with wheat and barley. He can earn Rs 5000 for every acre he plants with wheat and Rs 3000 for every acre he plants with barley. His use of a necessary pesticide is limited by federal regulation to 10 gallons for his entire 8 acres. Wheat requires 2 gallons of pesticide for every acre planted and barley requires just 1 gallon per acre. What is the maximum profit he can make? **07**

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

$$\text{Maximize } z = x_1 + 2x_2 + x_3$$

$$\text{Subjected to } 2x_1 + x_2 + x_3 \leq 6$$

$$. 2x_1 + x_2 + 5x_3 \leq 6$$

$$4x_1 + x_2 + x_3 \leq 6$$

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

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

OR

- (b) Find the minimum or maximum, if any, for the function **07**

$$f(x) = 4x^3 - 18x^2 + 27x - 7$$

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)** Explain the significance of post optimality analysis of a simplex linear programming problem. **07**

How does simplex algorithm indicate that:

1. There is an alternate optimal solution?
2. The problem has unbounded optimal solution?
3. The problem has no feasible solution?

- (b)** The cost to perform different jobs by different workers is given as follows: **07**

Company	JOB			
	1	2	3	4
A	90	18	48	50
B	72	28	85	80
C	53	92	12	78
D	20	70	70	25

Obtain optimal assignment of jobs to Company. Use branch and bound method to solve the given integer programming problem.

- Q.4 (a)** Find the minimum of the function $F = x^5 - 5x^3 - 20x + 10$ using golden section method in the interval of (0,5) **07**

- (b)** What is SLP Method. why it is calling Cutting Plane method **07**

OR

- Q.4 (a)** Explain dynamic programming. How is it different from linear programming? Distinguish between deterministic and probabilistic dynamic programming and give some examples where dynamic programming may be used. **07**

- (b)** Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius. Use direct substitution method. **07**

- Q.5 (a)** State the necessary and sufficient conditions for the minimum of a function $f(X)$. **07**

Also determine the maximum and minimum values of the function:

$$f(X) = 12X^5 - 45X^4 + 40X^3 + 5$$

- (b)** Show that volume of the largest right circular cylinder that can be inscribed in given right circular cone is 4/9th the volume of cone. **07**

OR

- Q.5 (a)** Explain some of the practical application of integer programming problem **07**

- (b)** Find extreme points of the function **07**

$$f(X_1, X_2) = X_1^3 + X_2^3 + 2X_1^2 + 4X_2^2 + 6$$
