Con.3330-07. 13/6/07 M E (Mech) Sem II P T DC (Machine Design) Optimization.

BB-1672 Stutt

(4 Hours) [Total Marks : 100

N.B. (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** out of remaining **six** questions.

M.E(M) Sem II PTDC M/C Design Optimization

1. (a) Minimize :— 10

$$Z = 3x_1 + 2x_2$$

Subjected to —

$$5x_1 + x_2 \geq 10$$
$$2x_1 + 2x_2 \geq 12$$
$$x_1 + 4x_2 \geq 12$$
$$x_1, x_2 \geq 0$$

(b) (i) State the necessary and sufficient condition for maximization of multi variable function f(x). 5
(ii) Explain the significance of Lagrange's Multiplier. 5

2. A gear manufacturing company received an order for three specific types of gears for regular supply. The production planning in-charge is considering to devote the available excess capacity to one or more of the three types say S, W, B. The available capacity of the machines which might limit output and the number of machine hours required for each unit of the respective gear is also given below. The unit profit would be Rs. 10, Rs. 30 and Rs. 40 respectively for gears S, W, B. 20

Machine Type	Available Machine hrs/week	Productivity in M/c hrs/Unit		
		Gear S	Gear W	Gear B
Milling M/c	300	8	3	2
Hobbing M/c	150	4	1	2
Shaping M/c	50	6	1	1

Find how much of each gear the company should produce in order to maximize profit ?

3. (a) Discuss the procedures involved in the optimum design of gear train, minimizing the total weight of gear train is considered as objective. 10
(b) Explain the application of optimization technique in Engineering applications. 10

4. (a) Explain greedy algorithms and its application in finding shortest path between any given vertices of a graph. 10
(b) Find the minimum of the function — 10

$$f(x) = 10x^6 - 48x^5 + 15x^4 + 200x^3 - 120x^2 - 480x + 100$$

5. Write notes on the following :— 20
(a) Genetic algorithms
(b) Fibonacci Method to find maxima and minima of a function
(c) Non linear programming and constrained optimization techniques
(d) Stochastic programming.

6. (a) Explain elimination methods and compare exhaustive search and dichotomous search. 8
(b) (i) Explain Unimodal functions. 4

(ii) Find the minimum of $f = x^2 + \frac{54}{x}$ in the interval (0·0, 1·0) to within 10% of the exact value. 8

7. (a) A tent on a square base of side 2a consists of four vertical sides of height b surrounded by a regular pyramid of height h. If the volume enclosed by the tent is V, show that the area of canvas in the tent can be expressed as $\frac{2V}{a} - \frac{8ah}{3} + 4a\sqrt{h^2 + a^2}$ 10

Also show that the least area of the canvas corresponding to a given volume V, if a and h can both vary, is given by

$$a = \frac{\sqrt{5}\,h}{2} \quad \text{and} \quad h = 2b$$

(b) Find the dimensions of a rectangular box of volume V = 1000 cm³ for which the total length of the 12 edges is a minimum using the lagrange multiplier method. Also find the change in dimensions of the box when the volume is changed to 1200 cm³ by using the value found earlier. 10