[This question paper contains 3 printed pages]

Your Roll No

7236 **J**

M.Sc./I

OPERATIONAL RESEARCH

Course VIII–Non-Linear and Dynamic Programming

(Admission of 2001 and onwards)

Time 3 *Hours* *Maximum Marks* 75

(Write your Roll No on the top immediately on receipt of this question paper)

Attempt any **five** *questions*

All *questions carry equal marks*

1 (a) Show that positive linear combination of convex functions is convex

(b) Let $f_i(x)$ and b_i $(i = 1, \quad m)$ be concave functions and scalars respectively, then show that the set

$$S = \{X \in R^n \mid f_i(x) \geq b_i, \ i = 1, \quad m\}$$

is convex

(c) Prove that every local maxima of a convex function is global maxima

2 State and prove the duality theorems of a quadratic programming problem

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3 (a) Obtain the Kuhn-Tucker's optimality conditions for the following problem

$$\text{Max } f(x) = C^T x - \frac{1}{2} x^T Bx$$

$$\text{s.t} \quad Ax \leq b, \; x \geq 0$$

(b) Show that Kuhn-Tucker's optimality conditions are direct extension of complementary slackness conditions of linear programming problem

4 (a) Formulate Travelling Salesman problem as a 0-1 programming problem

(b) Discuss in details the Branch and Bound Technique to solve the Integer Programming Problem

5 Solve the following problem using Wolfe's Method

$$\text{Min} \quad f(x) = -4x_1 - 2x_2 + x_1^2$$

$$\text{s.t.} \; x_1 + x_2 \leq 2$$

$$x_1, \; x_2 \geq 0$$

6 Solve the following problems using Dynamic Programming Approach

(a) Maximize $f(x) = x_1 x_2 x_3 x_4$

$$s.t \quad x_1 + x_2 + 2x_3 + x_4 = 40$$

$$x_1, \; x_2, \; x_3, \; x_4 \geq 0$$

(b) Minimize $f(x) = \sum_{i=1}^{n} x_i^2$

s t $\sum_{i=1}^{n} x_i = b$

$x_i \geq 0 \quad i = 1, \quad , m$

7 Solve the following problem

Maximize $Z = 3x_1 + 2x_2$

s t $x_1 \leq 2$

$x_2 \leq 2$

$x_1 + x_2 \leq 3\,5$

$x_1, x_2 \geq 0$ and integers