Reg. No ..... Name **18P3643**

MSc DEGREE END SEMESTER EXAMINATION - OCTOBER 2018

SEMESTER 3 : MATHEMATICS

COURSE : **16P3MATT14 : OPERATION RESEARCH**

(For Regular - 2017 Admission & Supplementary - 2016 Admission)

Time : Three Hours Max. Marks: 75

Section A
Answer the following (1.5 marks each)

1. An oil engine manufacturer purchases lubricants at the rate of Rs. 42 per piece from a vendor. The requirement of these lubricants is 1800 per year. What should be the order quantity per order, if the cost per placement of an order is Rs. 16 and inventory carrying charge per rupee per year is only 20 paise.
2. What are the characteristics of an EOQ problem with finite production?
3. Define the Hessian matrix.
4. Explain Lagrange multipliers.
5. What is the difference between feasible and optimal solution.
6. Describe forward recursion ?
7. What do you mean by decomposable, for an optimization problem?
8. What is the general form of an integer L.P.P.? Give an example.
9. Explain the terms
   (a) Pruned (b) Fathomed
10. Define spanning Tree of a Graph.

(1.5 x 10 = 15)

Section B
Answer any 4 (5 marks each)

11. Minimize $f(x) = 3x_1^2 + x_2^2 + 2x_1x_2 + 6x_1 + 2x_2$ subject to $2x_1 - x_2 = 4$.
12. (a) Explain the Taylor's series development in two dimensions:
    (b) Suppose $f(x) = x_1^2 + x_1x_2 + x_2^2$. Evaluated at $x^* = [x_1, x_2] = [2, 3]$, $f(x^*) = 19$. What is $f(x)$ at $x = [3, 5]$?
13. Find $\max(u_1^2 + u_2^2 + u_3^2)$ subject to $u_1u_2u_3 \leq 6$ where $u_1, u_2, u_3 > 0$.
14. Maximize $8x_1 + 7x_2$ subject to

$$2x_1 + x_2 \leq 8$$
$$5x_1 + 2x_2 \leq 15$$
$$x_1, x_2 \geq 0.$$

15. Solve graphically,

$$\begin{aligned} \text{Maximize} \quad & z = x + 2y \\ \text{subject to,} \quad & 3x + 2y \leq 9 \\ & x \leq 2 \\ & x, y \geq 0 \text{ and integers.} \end{aligned}$$

16. Describe minimum path problem. Give an algorithm to find the minimum path when all the arc lengths are non-negative.

(5 x 4 = 20)

Section C
Answer the following (10 marks each)

17.1. (a) Explain EOQ problems with price breaks.
(b) Find the optimum order quantity for a product for which the price breaks are as follows:-

Quantity	Unit cost (Rs)
$0 \leq Q_1 < 800$	Re. 1.00
$800 \leq Q_2$	Re. 0.98

The yearly demand for the product is 1600 units per year, cost of placing an order is Rs. 5, the cost of storage is 10% per year.

OR

2. (a) Explain EOQ problem with instantaneous production and variable order cycle.
(b) Explain EOQ problem with instantaneous production and fixed order cycle.

18.1. Maximize the function, $f(x) = -3x^2 + 21.6x + 1$ with a minimum resolution of 0.5 over 6 functional evaluation. The optimal value of $f(x)$ is assumed to lie in the range $0 \leq x \leq 25$.

OR

2. Solve using Newton's method

$$\text{Minimize } f(x) = (3x_1 - 1)^3 + 4x_1x_3 + x_2^2$$

start the search from the point $x = (1, 2)$.

19.1. Solve using D.P. $u_1 + u_2 + u_3$ subject to $u_1u_2u_3 \leq 10, u_1 + u_2 + u_3 \leq 15, u_j > 0$.

OR

2. Solve using D.P,

$$\begin{aligned} \text{maximize} \quad & 4x_1 + 14x_2 \\ \text{subject to} \quad & 2x_1 + 7x_2 \leq 21 \\ & 7x_1 + 2x_2 \leq 21, x_1, x_2 \geq 0. \end{aligned}$$

20.1. (a) Solve using branch and bound method

$$\begin{array}{ll} \text{Maximize} & z = 2x_1 + 3x_2 \\ \text{Subject to} & 6x_1 + 5x_2 \leq 25, x_1 + 3x_2 \leq 10 \\ & x_1, x_2 \geq 0 \end{array}$$

and integers.

(b) Describe the algorithm for minimum path problem whose arc length is unrestricted in sign.

OR

2. (a) Explain the algorithm to find the minimum spanning tree using an example.

(b) Solve using Branch & bound, Maximise $z = 2x_1 + x_2$ subject to $x_1 \leq 3/2, x_2 \leq 3/2$, $x_1, x_2 \geq 0$ and integers.

(10 x 4 = 40)