Reg. No .... Name **20P3043**

MSc DEGREE END SEMESTER EXAMINATION - OCT/NOV 2020: JAN 2021

SEMESTER 3 : MATHEMATICS

COURSE : **16P3MATT14 : OPERATION RESEARCH**

(For Regular - 2019 Admission and Supplementary - 2016/2017/2018 Admissions)

Time : Three Hours Max. Marks: 75

PART A
Answer all (1.5 marks each)

1. Explain order cycle, and the two types of inventory review systems.
2. What are the characteristics of an EOQ problem with finite production?
3. Define the Hessian matrix.
4. Explain Lagrange multipliers.
5. Write the Kuhn-Tucker conditions for non linear optimization.
6. Describe about return function, decision variables and state transformation function?
7. What do you mean by decomposable, for an optimization problem?
8. What you mean by branching?
9. Prove that if an optimal solution of $X \in S_F$ is an integer or mixed integer. Then it is also an optimal solution of $X \in T_F$.
10. Explain the terms.
    (a) Circuit (b) Tree (c) Centre (d) Arboresence

(1.5 x 10 = 15)

PART B
Answer any 4 (5 marks each)

11. Explain Golden section search method.
12. Minimize $y(x) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$.
13. Find $\max(u_1^2 + u_2^2 + u_3^2)$ subject to $u_1 u_2 u_3 \leq 6$ where $u_1, u_2, u_3 > 0$.
14. Maximize $\phi_2 = f_2 f_1$ where $f_1 = u_1$, $f_2 = u_2$ subject to $1 \leq u_1 \leq 3$, $-1 \leq u_2 \leq 1$.
15. Find the maximum potential difference between v_1 and v_4 in the following graph
    $v =$ 1 2 3 4
    $u =$ (1,2) (1,3) (2,3) (3,4) (4,2) (1,4)
    subject to $-2 \leq f_2 - f_1 \leq 3, 6 \leq f_3 - f_2 \leq 10, f_4 - f_3 \leq -2,$
    $-2 \leq f_2 - f_4, 1 \leq f_4 - f_1 \leq 6, f_3 - f_1 \leq 7.$
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)

PART C
Answer any 4 (10 marks each)

17.1. (a) Explain EOQ problem with finite replenishment for an inventory problem with shortage.
(b) The demand for an item in a company is 18000 units per year, and the company can produce the items rate of 3000 per month. The cost of one setup is Rs. 500, and the holding cost of 1 unit per month is 15 paise. The shortage cost of one unit is Rs. 20 per

month. Determine

i. Optimum production batch quantity and the number of strategies.
ii. Optimum cycle time and production time
iii. Maximum inventory level in the cycle
iv. Total associated cost per year if the cost of the item is Rs. 20 per unit.

OR

2. (a) Explain the EOQ problem with finite replenishment.
(b) A contractor has to supply 10000 bearings per day to an automobile manufacturer. He finds that what he starts a production run, he can produce 25000 bearings per day. The cost of holding a bearing in stock for one year is Rs. 2 and the setup cost of a production run is Rs. 1800. How frequently should production run be made?

18.1. 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 $x = (1, 2)$.

OR

2. Solve the following problem using the Kuhn-Tucker conditions:

$$\begin{aligned} \text{Min } f(x) &= 100 - 1.2x_1 - 1.5x_2 + 0.3x_1^2 + 0.05x_2^2 \\ \text{subject to} \quad g_1(x) &= x_1 + x_2 \geq 35 \\ g_2(x) &= x_1 \geq 0, \; g_3(x) = x_2 \geq 0. \end{aligned}$$

19.1. Solve using D.P $\max\{u_1^2 + u_2^2 + u_3^2\}$ subject to $u_1u_2u_3 \leq 6$, u_1, u_2, u_3 are positive integers.

OR

2. Using D.P solve the following

$$\begin{aligned} \text{maximize} \quad & z = x_1 + 9x_2 \\ \text{subject to} \quad & 2x_1 + x_2 \leq 25 \\ & x_2 \leq 11 \\ & x_1, x_2 \geq 0. \end{aligned}$$

20.1. (a) Describe the algorithm for minimum path problem with all are length non negative.
(b) Find the minimum path from v_0 to v_8 in the graph in which the number along a directed arc denotes its length.

Arc	(0,1)	(1,4)	(4,7)	(7,4)	(0,2)	(0,3)	
Length	2	10	3	2	6	8	
Arc	(1,5)	(1,2)	(2,5)	(5,4)	(5,7)	(2,3)	(3,5)
Length	8	3	1	1	5	1	2
Arc	(3,6)	(6,7)	(7,6)	(6,8)	(7,8)		
Length	2	6	1	7	10		

OR

2. Find the maximum non-negative flow in the following network.

Arc	$(a,1)$	$(a,2)$	(1,2)	(1,3)	(1,4)	(2,4)	(3,2)	(3,4)	(4,3)	$(3,b)$	$(4,b)$
Capacity	8	10	3	4	2	8	3	4	2	10	9

(10 x 4 = 40)