Code No: 156FP **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, July - 2023
OPERATIONS RESEARCH
(Computer Science and Business Systems)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Define Operations Research (O.R.). [2]
b) State the different types of models used in O.R. [3]
c) Define Sensitivity Analysis. [2]
d) Write the dual of LPP Min $Z = 4x_1 + 6x_2 + 18x_3$ subject to $x_1 + 3x_2 \geq 3$, $x_2 + 2x_3 \geq 5$ and $x_1, x_2, x_3 \geq 0$. [3]
e) Define Total and Free Floats. [2]
f) If there are five activities P, Q, R, S and T such that P, Q, R have no immediate predecessors but S and T have immediate predecessors P, Q and Q, R respectively. Represent this situation by a Network. [3]
g) Write the types of Inventory. [2]
h) Define posynomial. [3]
i) Define Vertex and Edge. [2]
j) Find the value of the game: $\begin{bmatrix} 1 & 3 & 1 \\ 0 & -4 & -3 \\ 1 & 5 & -1 \end{bmatrix}$ [3]

PART – B

(50 Marks)

2. Explain the optimization techniques in Operations Research. [10]

OR

3. Use simplex method to solve the LPP
Max $Z = 4x_1 + 10x_2$
subject to $2x_1 + x_2 \leq 50$,
$2x_1 + 5x_2 \leq 100$,
$2x_1 + 3x_2 \leq 90$,
and $x_1, x_2 \geq 0$ [10]

4. A company manufactures 2 types of printed circuits. The requirements of transistors, resistors and capacitors for each type of printed circuits along with other data are given below:

	Circuit		Stock Available
	A	B	
Transistor	15	10	180
Resistor	10	20	200
Capacitor	15	20	210
Profit	Rs. 5	Rs. 8	

How many circuits of each type should the company produce from the stock to earn maximum profit using Graphical method? [10]

OR

5. Consider the LPP

Max $Z = 2x_1 + x_2 + 4x_3 - x_4$

subject to $x_1 + 2x_2 + x_3 - 3x_4 \leq 8$

$-x_2 + x_3 + 2x_4 \leq 0$

$2x_1 + 7x_2 - 5x_3 - 10x_4 \leq 21$

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

a) Solve the LPP

b) Discuss the effect of change of b_2 to 11 on the optimal solution. [5+5]

6. Solve graphically the following NLPP:

Maximize $z = 2x_1 + 3x_2$

subject to the constraints, $x_1x_2 \leq 8$

$x_1^2 + x_2^2 \leq 20$

and $x_1, x_2 \geq 0$.

Verify that the Kuhn-Tucker conditions hold for the maxima you obtain. [10]

OR

7. A project consists of the following activities and time estimates:

Activity	Least time (Days)	Greatest Time(Days)	Most Likely Time (Days)
1-2	3	15	6
2-3	2	14	5
1-4	6	30	12
2-5	2	8	5
2-6	5	17	11
3-6	3	15	6
4-7	3	27	9
5-7	1	7	4
6-7	2	8	5

a) Draw the network
b) Find the critical path
c) Determine the expected standard deviation of the completion time. [10]

8. Find the sequence that minimizes the total elapsed time required to complete the following jobs on machines M_1, M_2 and M_3 in order M_1, M_2, M_3. [10]

Task	A	B	C	D	E	F
M_1	8	3	7	2	5	1
M_2	3	4	5	2	1	6
M_3	8	7	6	9	10	9

OR

9. A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs Rs.20. The ordering cost per order is Rs.15 and the carrying charges are 15% of the average inventory per year. You have been asked to suggest a more economical purchasing policy for the company. What advice would you offer, and how much would it save the company per year? [10]

10. Solve the following LPP using dynamic programming approach:
Max $Z = 3x_1 + 5x_2$
subject to $x_1 \leq 4$,
$x_2 \leq 6$,
$3x_1 + 2x_2 \leq 18$,
and $x_1, x_2 \geq 0$ [10]

OR

11. Use the notion of dominance to simplify the rectangular game with the following payoff, and solve it graphically. [10]

Player K

Player L $\begin{bmatrix} 18 & 4 & 6 & 4 \\ 6 & 2 & 13 & 7 \\ 11 & 5 & 17 & 3 \\ 7 & 6 & 12 & 2 \end{bmatrix}$

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