

subject to :

$$-2x_1 + x_2 + x_3 \leq 2$$

$$-x_1 + x_2 - x_3 \leq 1$$

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

Section C

5. ABC manufacturing company wishes to develop a monthly production schedule for the next three months. Depending upon the sales commitments, the company can either keep the production constant, allowing fluctuations in inventory or inventories can be maintained at a constant level, with fluctuating production. Fluctuating production necessitates in working overtime, the cost of which is estimated to be double the normal production cost of Rs. 12 per unit. Fluctuating inventories result in inventory carrying cost of Rs. 2 per unit. If the company fails to fulfil its sales commitment, it incurs a shortage cost of Rs. 4 per unit per month. The production capacities for the next three months are shown below :

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Month	Production Capacity		Sales
	Regular	Overtime	
1	50	30	60
2	50	0	120
3	60	50	40

Determine the optimal production schedule.

Roll No.

Total Pages : 07

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B. Tech. EXAMINATION, 2022

Semester VI (CBCS)

OPERATIONS RESEARCH

ME-604

Time : 3 Hours

Maximum Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. 9 is compulsory. Any missing data may be assumed appropriately.

Section A

1. (a) For the Reddy Mikks model, construct each of the following constraints and express it with a linear left-hand side and a constant right-hand side :

- (ii) The daily usage of raw material M2 in tons is at most 6 and at least 3. 4
- (iii) The demand for interior paint cannot be less than the demand for exterior paint. 6
- (iv) The minimum quantity that should be produced of both the interior and the exterior paint is 3 tons.
- (b) Solve the following LPP :

$$\text{Maximize : } Z = 5x_1 + 4x_2$$

Subject to :

$$6x_1 + 4x_2 \leq 24$$

$$x_1 + 2x_2 \leq 6$$

$$-x_1 + x_2 \leq 1$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

2. Show and sell can advertise its products on local radio and television (TV). The advertising budget is limited to \$10,000 a month. Each minute of radio advertising costs \$15 and each minute of TV commercials \$300. Show and Sell likes to advertise

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radio at least twice as much as on TV. In the meantime, it is not practical to use more than 400 minutes of radio advertising a month. From past experience, advertising on TV is estimated to be 25 times as effective as on radio. Determine the optimum allocation of the budget to radio and TV advertising. 10

Section B

3. Solve the following transportation problem by Vogel's approximation method (VAM), and perform optimality test using MODI. 10

Plant	Distribution Centre (Transportation Cost)				Supply
	1	2	3	4	
1	2	3	11	7	6
2	1	0	6	1	1
3	5	8	15	9	10
Demand	7	5	3	2	

4. Use simplex method to verify that the following problems has no optimal solution :
 Maximize : $Z = x_1 + 2x_2$

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P.T.O.

E : Rehearsals	D	70
F : Rent candelabra	D	14
G : Decorate candelabra	F	1
H : Set up decorations	D	1
I : Order choir robe stolen	D	7
J : Check out public address system	D	7
K : Select music tracks	J	14
L : Set up public address system	K	1
M : Final rehearsal	E,G,L	1
N : Choir party	H,L,M	1
O : Final program	I,N	1

- (g) Define zero sum game
- (h) Define constraints.
- (i) Define pay-off as applied to decision theory.
- (j) Define Operation Research. 2×10=20

(Compulsory Question)

9. (a) What is meant by degeneracy in a transportation model ?
- (b) What is an unbalanced case in an assignment model ?
- (c) Define Saddle point.
- (d) What criteria in decision-making under risk deals with maximizing profit ?
- (e) List the scope of applications of OR techniques.
- (f) List the methods used to arrive at an initial basic feasible solution in a transportation model.

6. Solve graphically :

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		Player B			
		I	II	III	IV
Player A	I	8	5	-7	9
	II	-6	6	4	-2

Section D

7. Find the activity network, critical path and float calculation for the construction project as follow :

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Activity	:	A	B	C	D	E	F
Preceding activity	:	-	-	A	A	B,C	D,E
Normal time (days)	:	16	20	8	10	6	12

8. The activities involved in a candlelight choir service are listed in the following table. Construct the project network :

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Activity	Predecessor(s)	Duration (days)
A : Select music	-	2
B : Learn music	A	14
C : Make copies and buy books	A	14
D : Tryouts	B,C	3