CBCS SCHEME

17ME81

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023
Operations Research

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of Normal distribution table permitted.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define Operation Research and discuss the phases in Operation Research. **(10 Marks)**

b. Solve graphically the given LP problem,

Minimize $z = 3a + 5b$

Subjected to constraints, $-3a + 4b \le 12$

$2a - 1b \ge -2$

$2a + 3b \ge 12$

$1a + 0b \ge 4$

$0a + 1b \ge 2$

$a, b \ge 0$ **(10 Marks)**

OR

2 a. List any 4 characteristics and limitations of OR. **(08 Marks)**

b. Two alloys A and B are made from four different metals I, II, III and IV according to the following specifications. 'A' at most 80% of I at most 30% of II, at least 50% III. 'B' between 40% and 60% of II, at least 30% of III, at most 70% of IV. The four metals are extracted from 3 different ores whose constituents percentage of these metals, maximum available quantity and cost per tonne are as follows :

Ore	Max Quantity	Constituent %					Price (Rs./Tonne)
		I	II	III	IV	Others	
1	1000	20	10	30	30	10	30
2	2000	10	20	30	30	10	40
3	3000	5	5	70	20	0	50

Assuming the selling price of alloys A and B are Rs.200 and Rs.300/tonne respectively. Formulate the above as a linear programming problem selecting appropriate objectives and constraints functions. **(12 Marks)**

Module-2

3 a. Solve the following LPP by Simplex method:

Maximize $z = 12x_1 + 16x_2$

Subject to Constraints $10x_1 + 20x_2 \le 120$

$8x_1 + 8x_2 \le 80$

x_1 and $x_2 \ge 0$. **(10 Marks)**

b. Minimize $z = 7x_1 + 15x_2 + 20x_3$

Subject to Constraints $2x_1 + 4x_2 + 6x_3 \ge 24$

$3x_1 + 9x_2 + 6x_3 \ge 30$

$x_1, x_2, x_3 \ge 0$

using Big M method. **(10 Marks)**

OR

4 a. Solve the following LPP by simplex,

$Z\ \text{Min} = 2x_1 - 3x_2 + 6x_3$

Subject to Constraints $3x_1 - x_2 + 2x_3 \le 7$

$2x_1 + 4x_2 \ge 12$

$-4x_1 + 3x_2 + 8x_3 \le 10$

$x_1, x_2, x_3 \ge 0$ **(10 Marks)**

b. Solve by dual simplex method.

$\text{Min}\ z = 5x_1 + 6x_2$

Subject to Constraints $x_1 + x_2 \ge 2$

$4x_1 + x_2 \ge 4$

$x_1, x_2 \ge 0$ **(10 Marks)**

Module-3

5 a. Obtain an Initial basic feasible solution to the transportation problem using North West corner rule and least cost method.

Origin	D_1	D_2	D_3	
O_1	2	7	4	5
O_2	3	3	1	8
O_3	5	4	7	7
O_4	1	6	2	14
	8	8	18	

(Destination across the top)

(06 Marks)

b. There are 3 factories A, B, C supplying goods to four dealers D_1, D_2, D_3 and D_4. The production capacities and requirements are given in the table. The project in Rs. is also given. Determine the optimum solution to maximize the profits.

	D_1	D_2	D_3	D_4	Capacity
A	22	26	20	21	450
B	21	24	20	19	300
C	18	20	19	20	250
Requirement	200	300	150	270	

(14 Marks)

OR

6 a. A company has 3 plants at location A, B and C which supplies to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. The monthly warehouse requirement are 400, 400, 500, 400 and 800 units respectively. Unit transportation cost is given below. Determine the optimum distribution such that the company minimizes the cost.

	D	E	F	G	H
A	5	8	6	6	3
B	4	7	7	6	6
C	8	4	6	6	4

(16 Marks)

b. List any 4 applications of Transportation problems. **(04 Marks)**

Module-4

7 a. State and explain the characteristics of queing system. **(06 Marks)**

b. Data of a project is given below :

Activity	Immediate Predecessor	Optimistic Time Hrs	Most likely Time Hrs	Pessimestic Time (Hrs)
A	-	4	6	8
B	-	1	4.5	5
C	A	3	3	3
D	A	4	5	6
E	A	0.5	1	1.5
F	B, C	3	4	5
G	B, C	1	1.5	5
H	E, F	5	6	7
I	E, F	2	5	8
J	D, H	2.5	2.75	4.5
K	G, I	3	5	7

(i) Draw the network diagram.
(ii) Find out the ES, EF, LS, LF and slack for each activity.
(iii) Find out the variance and standard deviation for the critical path.
(iv) Determine the probability of completing the project in 24 hours. **(14 Marks)**

OR

8 a. Define
(i) Critical activity and critical path.
(ii) Total float.
(iii) Free float.
(iv) AOA and AON diagram. **(08 Marks)**

b. In a railway yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows are exponential distribution and the service time distribution is also exponential with an average 36 minutes.
Calculate the following :
(i) The average number of trains in the queue.
(ii) The probability that the queue size exceed 10.
(iii) Expected waiting time in the queue.
(iv) Average number of trains in the queue.
(v) If the input of trains increase to an average 33 per day, what would be the changes in (i) and (ii) ? **(12 Marks)**

Module-5

9 a. Consider the following single machine sequencing :

Job	J_1	J_2	J_3	J_4	J_5
Processing Time	14	8	6	4	16

Obtain
(i) Optimal sequence by STP rule.
(ii) Completion time of all the jobs.
(iii) Mean flow time.
(iv) Number of Tardy jobs if due date is 20 days. **(08 Marks)**

b. Obtain the optimal strategies for both persons and the value of the game for 2 person zero sum game whose payoff matrix is as follows :

		Player B	
		B_1	B_2
Player A	A_1	1	-3
	A_2	3	5
	A_3	-1	6
	A_4	4	1
	A_5	2	2
	A_6	-5	0

(12 Marks)

OR

10 a. Use graphical method to minimize the time needed to process the following jobs on the machines A B C D and E. For each machine find which jobs is to be loaded first. Calculate the total time required to process the jobs. The time given is in hours. The machining order for Job 1 is A B C D E and takes 3, 4, 2, 6, 2 hours respectively on the machines. The order of machines for Job 2 is B C A D E and takes 5, 4, 3, 2, 6 hours respectively for processing. (12 Marks)

b. Solve the following game by using concept of dominance.

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	3	2	4	0
	A_2	3	4	2	4
	A_3	4	2	4	0
	A_4	0	4	0	8

(08 Marks)

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