CBCS SCHEME

USN | | | | | | | | | | |

17ME81

Eighth Semester B.E. Degree Examination, July/August 2021
Operations Research

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. List and explain the phases of operations research. **(08 Marks)**

b. A diet of a sick person must contain atleast 4,000 units of vitamins, 50 units of minerals and 1400 calories. Two foods are available at a cost of Rs.4 and Rs.3 per unit respectively for A and B types. If food A contains 200 units of vitamins, 1 unit of mineral and 40 calories and if food B contains 100 units of vitamins, 2 units of mineral and 40 calories, formulate this problem as LPP model and solve it by graphical method to find the least cost with minimum requirement of the ingredients. **(12 Marks)**

2 a. Discuss the scope of operations research. **(06 Marks)**

b. Use graphical method to solve the following LPP.

Maximize $Z = 2x_1 + 3x_2$

Subjected to constraints (i) $x_1 + x_2 \le 30$ (ii) $x_2 \ge 3$ (iii) $0 \le x_2 \le 12$

(iv) $0 \le x_1 \le 20$ (v) $x_1 - x_2 \ge 0$; $x_1, x_2 \ge 0$ **(14 Marks)**

3 a. What is the significance of introducing slack, surplus and artificial variables in LPP? **(04 Marks)**

b. Solve the following LPP by simplex method:

Maximize $Z = 4x_1 + 3x_2$

Subject to constraints (i) $2x_1 + x_2 \le 1000$ (ii) $x_1 + x_2 \le 800$ (iii) $x_1 \le 400$ (iv) $x_2 \le 700$ **(16 Marks)**

4 Solve the given problem using Big M method.

Maximize $Z = -2x_1 - x_2$

Subject to $3x_1 + x_2 = 3$, $4x_1 + 3x_2 \ge 6$, $x_1 + 2x_2 \le 4$, $x_1, x_2 \ge 0$ **(20 Marks)**

5 a. What is degeneracy in transportation problem? Discuss how it can be overcome. **(04 Marks)**

b. L & T Company needs 3, 3, 4 and 5 million cubic feet of fill at 4 earthen dam sites I, II, III and IV in Karnataka. It can transfer the fill from 3 mounds A, B and C where 2, 6 and 7 million cubic feet of fill is available respectively. Costs of transportation for one million cubic feet of fill from 3 mounds to the 4 sites in lakhs of rupees are given in the table below (Table.Q5(b)). Determine the optimal transportation plan which minimizes cost to company.

	Sites			
Mounds	I	II	III	IV
A	15	10	17	18
B	16	13	12	13
C	12	17	20	11

Table.Q5(b)

(16 Marks)

6 a. What do you understand by a balanced and unbalanced transportation problem? How an unbalanced problem is tackled? **(06 Marks)**

b. A product is produced by four factories A, B, C and D and their unit production costs in them are Rs.2, 3, 1 and 5 respectively. Their production capacities are factory A – 50 units, B – 70 units, C – 30, D – 50 units. These supply the products to four stores with their demands of 25, 35, 105 and 20 units respectively. Unit transportation cost from each factory to each store is given in Table.Q6(b). Determine the extent of deliveries from each factory to each store, so that total cost of production cum transportation is minimum.

Table.Q6(b)

Factories \ Stores	1	2	3	4
A	2	4	6	11
B	10	8	7	5
C	13	3	9	12
D	4	6	8	3

(14 Marks)

7 A small project is composed of activities with their time estimates listed in Table.Q7.

a. Draw project network

b. Find expected duration and variance of each activity and its expected project length

c. What is the probability of completing project:

(i) Atleast 4 weeks earlier than expected.

(ii) If project is due in 19 weeks, what is the probability of meeting the due date?

Table.Q7

Activity	t_o	t_m	t_p
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

(20 Marks)

8 a. State and explain in brief Kendall's notation for representing queing models. **(06 Marks)**

b. A self service store employs one cashier at its counter. An average of 9 customers arrive every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution of arrival rate and exponential distribution of service rate find:

(i) Average number of customers in system

(ii) Average number of customers in queue

(iii) Average time a customer spends in system

(iv) Average time a customer waits before being served. **(14 Marks)**

9 a. Explain the following terms: (i) Pay off matrix (ii) Saddle point (iii) Fair game **(06 Marks)**

b. Use dominance rule to find the optimum strategies for both players.

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \end{array} \begin{array}{c} \begin{array}{cccccc} B_1 & B_2 & B_3 & B_4 & B_5 & B_6 \end{array} \\ \begin{bmatrix} 4 & 2 & 0 & 2 & 1 & 1 \\ 4 & 3 & 1 & 3 & 2 & 2 \\ 4 & 3 & 7 & -5 & 1 & 2 \\ 4 & 3 & 4 & -1 & 2 & 2 \\ 4 & 3 & 3 & -2 & 2 & 2 \end{bmatrix} \end{array}$$

(14 Marks)

10 a. State assumptions made while applying Johnson's rule to n jobs on 2 machines. **(06 Marks)**

b. Use graphical method to minimize the time required to process the jobs. Details of processing time (hrs) and sequence given below:

Job 1:	A – 4, C – 2, D – 6, E – 3, B – 2
Job 2:	C – 8, A – 3, D – 4, B – 2, E – 3

Find sequence of jobs on each machine and total elapsed time for both jobs. **(14 Marks)**