USN | | | | | | | | | | | **17ME81**

Eighth Semester B.E. Degree Examination, July/August 2022
Operations Research

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Discuss the origin and development of Operation Research (OR). **(06 Marks)**

b. Explain the various phases in Operation Research development process. **(08 Marks)**

c. Discuss the applications of Operation Research. **(06 Marks)**

OR

2 a. Explain the assumptions made in Linear Programming Problems (LPP). **(08 Marks)**

b. The company ABC manufactures two types of wooden toys of soldiers and trains. Each soldier toy contribute the profit of Rs.3 and each train toy contribute the profit of Rs.2. Each soldier toy needs 2 hr finishing and 1 hr carpentary time. Each train toy needs 1 hr finishing and 1 hr carpentary time. Only 100 hrs of finishing and 80 hrs of carpentary timings are available in each week. The demand for soldiers toy is atmost limited to 40 in each week. Formulate the above problem as LPP. Solve the above problem using graphical method to find how many each toy should be made in each week to maximize the profit. **(12 Marks)**

Module-2

3 a. Explain the following:

(i) Slack variable
(ii) Surplus variable and
(iii) Artificial variable. **(06 Marks)**

b. Use Penalty (or Big-M) method to solve following LPP :

Minimize $z = 4x_1 + 3x_2$

Subjected to $2x_1 + x_2 \geq 10$

$-3x_1 + 2x_2 \leq 6$.

$x_1 + x_2 \geq 6$.

$x_1, x_2 \geq 0$ **(14 Marks)**

OR

4 a. Write the relationship between primal and dual LPPs. **(06 Marks)**

b. Solve the following LPP by Dual-Simplex method:

Minimize $z = 6x_1 + 7x_2 + 3x_3 + 5x_4$

Subjected to, $5x_1 + 6x_2 - 3x_3 + 4x_4 \geq 12$

$x_2 + 5x_3 - 6x_4 \geq 10$.

$2x_1 + 5x_2 + x_3 + x_4 \geq 8$

$x_1, x_2, x_3, x_4 \geq 0$ **(14 Marks)**

Module-3

5 a. What is degeneracy in transportation problems and how it is resolved? **(06 Marks)**

b. A steel company has three open hearth furnaces and five rolling mills. The transportation costs for shipping steel from furnaces to rolling mills are given in the following table with supply and demand requirements:

	M_1	M_2	M_3	M_4	M_5	Supply
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
Demand	4	4	6	8	8	

What is the optimum shipping schedule? Use VAM's method for IBFs and MODI method for finding optimal solution. **(14 Marks)**

OR

6 a. What is assignment problem? How does it differ from a transportation problem? **(06 Marks)**

b. A computer centre has four expert programmers and needs to develop four application programmes. The head of the computer centre estimates computer time (in minutes) required by the respective experts to develop the application programmes is as follows:

		Programmes			
		A	B	C	D
	1	120	100	80	90
Programmers	2	80	90	110	70
	3	110	140	120	100
	4	90	90	80	90

Find the assignment pattern that minimizes the time required to develop the programmes. **(14 Marks)**

Module-4

7 a. Compare the PERT and CPM in network analysis. **(06 Marks)**

b. A small project consist of following activities and the time estimates:

Activity	Most optimistic time (weeks)	Most likely Time (weeks)	Most Pessimistic time (weeks)
1 – 2	4	8	12
1 – 3	4	10	12
1 – 4	8	14	24
2 – 5	5	8	10
3 – 4	2	5	8
3 – 5	2	4	8
4 – 5	6	10	14
5 – 6	1	3	6

Determine the following :

(i) Construct the operational networks.
(ii) Find the critical path.
(iii) Calculate the expected time of completing the project.
(iv) What is the probability of completing the project is more than 26 weeks. **(14 Marks)**

OR

8 a. Explain various queuing disciplines and customer behaviours. **(08 Marks)**

b. Telephone users arrive at a booth following a Poisson's distribution with mean arrival time of 5 mins. The time taken for a telephone call is with mean of 3 mins and it follows exponential distribution. Find the following :
   (i) What is the probability that the booth is busy?
   (ii) Average waiting time in the queue?
   (iii) Average waiting time in the system? **(12 Marks)**

Module-5

9 a. Explain the following : (i) Pure strategy (ii) Mixed strategy (iii) Payoff matrix (iv) Saddle point (v) Value of the game. **(10 Marks)**

b. Solve the following game whose pay-off matrix is given below:

Player B

Player A		I	II	III
	I	-2	15	-2
	II	-5	-6	-4
	III	-5	20	-8

Use maximum (minmax) principle to find
   (i) Best strategy for Player A.
   (ii) Best Strategies for Player B.
   (iii) The value of the game. **(10 Marks)**

OR

10 a. Write any six assumptions made in sequencing problems. **(06 Marks)**

b. Determine the sequence in which books should be processed on the machines so that total time required is minimized. Also find (i) Total elapsed time (ii) Idle time of printing machine (iii) Idle time of binding machine.

Book	Printing Machine (Hrs)	Binding Machine (Hrs)
A	5	2
B	1	6
C	9	7
D	3	8
E	10	4

(Note : Machine timings are in Hrs) **(14 Marks)**

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