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15ME81

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

Time: 3 hrs.

Max. Marks: 80

**Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of SQL tables is permitted.**

### Module-1

- 1 a. List and explain the phases of operations research. (08 Marks)  
 b. A manufacturing Company is producing two products A and B. Each of the products A and B requires the use of two machines P and Q. Product A requires 4 hours of processing in Machine P and 3 hours of processing in Machine Q. Product B requires 3 hours of processing on Machine P and 6 hours of Processing on Machine Q. The unit profits of product A and B are Rs.20 and Rs.30 respectively. The available time in a given quarter on Machine P is 1000 hours and on Machine Q is 1200 hours. The market survey has predicted 250 units of product A and 300 units of product B can be consumed in a quarter. The company is interested in deciding the product mix to maximize the profits. Formulate the LPP model of this problem. (08 Marks)

**OR**

- 2 a. Discuss the applications of Operation research techniques. (08 Marks)  
 b. Solve the following LPP using graphical method:  
 Maximize  $z = 6x_1 + 8x_2$   
 Subject to  $5x_1 + 10x_2 \leq 60$   
 $4x_1 + 4x_2 \leq 40$   
 $x_1, x_2 \geq 0$  (08 Marks)

### Module-2

- 3 Solve the following LPP by simplex method.  
 Maximize  $z = 10x_1 + 20x_2$   
 Subject to  $3x_1 + 2x_2 \leq 1200$   
 $2x_1 + 6x_2 \leq 1500$   
 $x_1 \leq 350$   
 $x_2 \leq 200$   
 where  $x_1, x_2 \geq 0$  (16 Marks)

**OR**

- 4 a. Define the following:  
 (i) Unbounded solution (ii) Degenerate solution. (iii) Slack variable  
 (iv) Surplus variable (v) Basic variable. (10 Marks)
- b. Write the dual of the following LPP:  
 Maximize  $Z = 4x_1 + 10x_2 + 25x_3$   
 Subjected to  $2x_1 + 4x_2 + 8x_3 \leq 25$   
 $4x_1 + 9x_2 + 8x_3 \leq 30$   
 $6x_1 + 8x_2 + 2x_3 \leq 40$   
 where  $x_1, x_2$  and  $x_3 \geq 0$  (06 Marks)

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-3**

- 5 a. What is balanced and unbalanced transportation problem? How unbalanced transportation problem is converted into balanced transportation problem, show with example. (06 Marks)
- b. Find the initial basic feasible solution for Transportation Problem by VAM method. (10 Marks)

		Market					Supply
		1	2	3	4	5	
Plant	1	10	2	16	14	10	300
	2	6	18	12	13	16	500
	3	8	4	14	12	10	825
	4	14	22	20	8	18	375
Demand		350	400	250	150	400	

**OR**

- 6 a. For the given Transportation Problem with initial basic solution optimize the solution using MODI method. (10 Marks)

		1	2	3	4	Supply
1		<u>250</u>	<u>50</u>	7	4	300
2		2	<u>300</u>	<u>100</u>	9	400
3		8	3	<u>300</u>	<u>200</u>	500
Demand		250	350	400	200	

- b. Solve the assignment problem and find optimal assignment and total processing time. (06 Marks)

		Operator				
		A	B	C	D	E
Job	1	10	12	15	12	8
	2	7	16	14	14	11
	3	13	14	7	9	9
	4	12	10	11	13	10
	5	8	13	15	11	15

**Module-4**

- 7 Consider the table with details shown below of a project involving 14 activities:

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Immediate Predecessor	-	-	-	B	A	A	B	C, D	C, D	E	F,G,H	F,G,H	I	J,K
Duration(months)	2	6	4	3	6	8	3	7	2	5	4	3	13	7

- (i) Construct CPM network.  
 (ii) Determine critical path and project completion time.  
 (iii) Compute time schedules : EST, EFT, LST, LFT and Total floats, Free floats.

(16 Marks)

**OR**

- 8 a. Briefly describe the characteristics of Queueing system. (06 Marks)
- b. Patients arrive at a hospital reception counter at an average inter arrival rate of 2 min. The receptionist in duty takes an average of one minute per patients.
- What is the chance that patient will straight way meet the receptionist?
  - For what portion of time the receptionist is busy.
  - What is the average queue length?
  - What is the average numbers of patients in the system?
  - What is the average waiting time of a patient?
  - What average time a patient spends in system.

(10 Marks)

**Module-5**

- 9 a. Explain (i) Pay off matrix (ii) MAXIMIN – MINIMAX principle (iii) Saddle point (08 Marks)
- b. Solve the game, for two players A and B are playing a game of tossing a coin simultaneously ; Player A wins 1 unit of value when there are two heads, wins nothing when there are two tails and loses  $\frac{1}{2}$  unit of value when there is one head and one tail. Find the pay off matrix, the best strategies for each player and the value of game. (08 Marks)

**OR**

- 10 a. State the assumptions of sequencing problems. (06 Marks)
- b. A machine operator has to perform three operations turning, threading and knurling on a six jobs in that order. Determine the optimal schedule (sequence), total elapsed time and Idle times for the three machines.

Jobs	Turning machines (min)	Threading machine (min)	Knurling Machine (min)
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13

(10 Marks)

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