



**Avinashilingam Institute for Home Science and Higher Education for Women**  
 Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD (now MoE)  
 Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC  
 Coimbatore - 641 043, Tamil Nadu, India

**Continuous**

**Internal Assessment Test II –April 2025**

**VI Semester**

**Class : III UG**

**Time**

**: 2 hrs**

**Major : Mathematics**

**Maximum Marks: 60**

**21BMAC24 - Operations Research**

**Course Outcomes:**

- CO1: Construct Mathematical models for the real-time situations.
- CO2: Understand the mathematical tools needed to solve optimization problems.
- CO3: Find optimum solutions for transportation and assignment problems.
- CO4: Understand the game theory for decision support system.
- CO5: Apply optimum sequence algorithm for smooth functioning of an industry.

**Part-A**

**6x1=6**

**Choose the correct answer**

- 1.The assignment problem is a special case of transportation problem in which number of origins\_\_\_\_\_ CO3K2
  - a. equals the number of destinations.
  - b. is greater than the number of destinations.
  - c. is less than the number of destinations.
  - d. is less than or equal to the number of destinations.
- 2.If there are n workers and n jobs, there would be\_\_\_\_\_. CO3K1
  - a. n Solutions
  - b.  $x_{ij}$  Solution
  - c.  $(n-1)!$  Solutions
  - d.  $(n!)^n$  Solutions
- 3.A two person game is said to be zero-sum, if CO4K1
  - a. gain of one player is exactly matched by a loss to the other so that their sum is equal to zero.
  - b. gain of one player does not match the loss to the other.
  - c. both the players must have an equal number of strategies.
  - d. diagonal entries of the pay-off matrix are zero.
4. A game is said to be fair, if CO4K1
  - a. upper value is more than lower value of the game.
  - b. upper and lower values of the game are not equal.
  - c. upper and lower values of the game are same and zero.
  - d. none of the above.
5. A sequencing problem involving six jobs and three machines requires evaluation of: CO5K2
  - a.  $(6! + 6! + 6!)$  sequences
  - b.  $(6!)^3$  sequence
  - c.  $(6 \times 6 \times 6)$  sequences
  - d.  $(6 + 6 + 6)$  sequences.
- 6.Sequencing problems involving processing of two jobs on 'n' machines CO5K1
  - a. can be solved graphically
  - b. cannot be solved graphically
  - c. have a condition that the processing of two jobs must be in the same order
  - d. none of the above.

**Part- B**

**3x6=18**

**Answer ALL Questions**

- 7.a. Find the starting solution in the following transportation problem by Vogel's Approximation Method. Also obtain the optimum solution: CO3K3

	D1	D2	D3	D4	Supply
S1	3	7	6	4	5

S2	2	4	3	2	2
S3	4	3	8	5	3
Demand	3	3	2	2	

(or)

7.b. A departmental head has four subordinates and four tasks to be performed. The subordinates differ in efficiency, and the tasks differ in their intrinsic difficulty. His estimate of the time each man would take to perform each task is given in the matrix below:

CO3K3

Tasks	Men			
	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

How should the tasks be allocated, one to a man, so as to minimize the total man-hours?

8.a. Determine the range of value of p and q that will make the payoff element  $a_{22}$ , a saddle point for the game whose payoff matrix  $a_{ij}$  is given below:

CO3K3

$$\begin{array}{c} \text{Player B} \\ \text{Player A} \begin{bmatrix} 2 & 4 & 7 \\ 10 & 7 & q \\ 4 & p & 8 \end{bmatrix} \end{array}$$

(or)

8.b. For the game with the following payoff matrix, determine the optimum strategies and the value of the game:

CO4K4

$$P_2 \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix}$$

9.a. We have 4 jobs, each of which has to go through the machines  $M_j$  ( $j=1,2,\dots,6$ ) in the order  $M_1,$

	Machines					
	$M_1$	$M_2$	$M_3$	$M_4$	$M_5$	$M_6$
Job A	18	8	7	2	10	25
Job B	17	6	9	6	8	19
Job C	11	5	8	5	7	15
Job D	20	4	3	4	8	12

$M_2, \dots, M_6$ . The processing time (in hours) is given below:

Determine a sequence of these four jobs that minimizes the total elapsed time.

CO5K4

(or)

9.b. Use graphical method to minimize the time added to process the following jobs on the machines shown, i.e., for each machine find the job which should be done first. Also calculate the time elapsed to complete both the jobs:

CO5K4

Job 1	Sequence	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence	A	B	C	D	E
	Time	5	4	3	2	6

Answer ALL questions

10.a. A pharmaceutical company is producing a single product and is selling it through five agencies located in different cities. All of a sudden, there is a demand for the product in another five cities not having any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to despatch the product to needy cities in such a way that the travelling distance is minimized. The distance between the surplus and deficit cities (in km) is given in the following table:

Surplus cities	Deficit cities				
	a	b	c	d	e
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

Determine the optimum assignment schedule.

CO3K4

(or)

10.b. ABC Limited has three production shops supplying a product to five warehouses. The cost of manufacture at each shop and the cost of transportation from one shop to a warehouse also vary. Each shop has a specific production capacity, and each warehouse has a certain amount of requirement. The costs of transportation are as given below:

Shop						Supply
	I	II	III	IV	V	
A	6	4	4	7	5	100
B	5	6	7	4	8	125
C	3	4	6	3	4	175
Demand	60	80	85	105	70	400

The cost of manufacture of the product at different production shops is:

Shop	Variable cost	Fixed cost
A	14	7000
B	16	4000
C	15	5000

Find the optimum quantity to be supplied from each shop to different warehouses at minimum total cost.

CO3K4

11.a. Solve the following 2x2 game graphically

CO4K4

$$\begin{array}{c}
 \text{Player B} \\
 B_1 \quad B_2 \quad B_3 \quad B_4 \\
 \text{Player A} \quad A_1 \begin{bmatrix} 2 & 1 & 0 & -2 \end{bmatrix} \\
 \quad \quad \quad A_2 \begin{bmatrix} 1 & 0 & 3 & 2 \end{bmatrix} \\
 \text{(or)}
 \end{array}$$

11. b. Use graphical method in solving the following game

CO4K4

$$\begin{array}{c}
 \text{Player A} \\
 \text{Player B} \quad \begin{bmatrix} 2 & 2 & 3 & -2 \\ 4 & 3 & 2 & 6 \end{bmatrix}
 \end{array}$$

- 12.a. In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing timings (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time, T. What is the value of T? CO5K4

Job	J1	J2	J3	J4	J5	J6
Machine A	1	3	8	5	6	3
Machine B	5	6	3	2	2	10

(or)

- 12.b. Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information. Processing time on machines is given in hours and passing is not allowed. CO5K4

Job	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	13

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