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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

MBA (Integrated)

SEM: V - THEORY EXAMINATION (2025 - 2026)

Subject: Operations Research

Time: 2.5 Hours

Max. Marks: 60

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

15

1. Attempt all parts:-

1-a. The term Operations Research was coined by: (CO1, K1)

1

- (a) J.F. Newman
- (b) F.N. Bellman
- (c) P.F. Adams
- (d) McCloskey and Trefethen

1-b. In transportation problem if total supply is less than total demand, we add: (CO2, K1)

1

- (a) dummy row with cost 0
- (b) dummy column with cost 0
- (c) dummy row with cost 1
- (d) dummy column with cost 1

1-c. In the Hungarian method of solving an assignment problem, the row reduction is obtained by: (CO3, K1)

1

- (a) Dividing each row by the elements of the row above it
- (b) Subtracting the elements of the row from the elements of the row above it
- (c) Subtracting the smallest element from all other elements of the row
- (d) Adding the row minima to each element

1-d. If there are 'n' jobs and 'm' machines, there will be -----sequences of doing the jobs (CO4, K1):

1

- (a) n
- (b) n+m
- (c) m

(d) $(n!)^m$

- 1-e. Float analysis is useful for _____. (CO5, K1) 1
- (a) Total float
 - (b) Free float
 - (c) Independent float
 - (d) None of these

2. Attempt all parts:-

- 2.a. Define slack variable and surplus variable in LPP. (CO1, K1) 2
- 2.b. Define an unbalanced transportation problem. (CO2, K1) 2
- 2.c. Define Pure strategy game.(CO3, K1) 2
- 2.d. State Johnson's Rule for solving a two-machine sequencing problem.(CO4, K1) 2
- 2.e. Define a network.(CO5, K1) 2

SECTION-B

15

3. Answer any three of the following:-

- 3-a. Solve the following LPP by graphical method: 5
- Minimize $Z = 5x + 4y$
subject to constraints $4x + y \geq 40$,
 $2x + 3y \geq 90$
and $x, y \geq 0$. (CO1, K3)

- 3-b. Find an initial basic feasible solution of the following problem using LCM method. 5
(CO2, K3)

	D ₁	D ₂	D ₃	D ₄	SUPPLY
O ₁	5	3	6	2	19
O ₂	4	7	9	1	37
O ₃	3	4	7	5	34
DEMAND	16	18	31	25	

- 3.c. Solve the game whose payoff matrix is given below and determine its value. (CO3, K3) 5

$$\begin{matrix} & \text{Player B} \\ \text{Player A} & \begin{bmatrix} 6 & -3 \\ -3 & 3 \end{bmatrix} \end{matrix}$$

- 3.d. Write a short note on the 'sequencing decision problem for n jobs on two machines'. (CO4, K2) 5

- 3.e. Develop a network diagram for the project specified below: (CO5, K2) 5

Activity	Immediate Predecessor Activity
A	-
B	A
C, D	B
E	C
F	D
G	E, F

SECTION-C

30

4. Answer any one of the following:-

4-a. Solve by simplex method:

$$\text{Max } Z = x + y + 3z$$

$$\text{Subject to } 3x + 2y + z \leq 3,$$

$$2x + y + 2z \leq 2,$$

$$x, y, z \geq 0. \text{ (CO1, K3)}$$

6

4-b. A manufacturer produces two models A and B. A requires 4 hrs grinding, 2 hrs polishing; B requires 2 hrs grinding, 5 hrs polishing. Two grinders (40 hrs each) and 3 polishers (60 hrs each). Profits Rs.3 and Rs.4. Formulate LPP to maximize weekly profit. (CO1, K3)

6

5. Answer any one of the following:-

5-a. Find the optimum solution to the following Transportation Problem (CO2, K3)

6

	D1	D2	D3	Available
O1	2	7	4	5
O2	3	3	1	8
O3	5	4	7	7
O4	1	6	2	14
Required	7	9	18	34

5-b. Find the initial basic feasible solution to the following Transportation Problem by using Vogel's Approximation Method. (CO2, K3)

6

	x	y	z	Supply
A	2	2	3	10
B	4	1	2	15
C	1	3	1	40
Demand	20	15	30	65

6. Answer any one of the following:-

6-a. A company has four machines of which to do three jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given below. Find the optimal assignment. (CO3, K3)

6

Jobs	Machines			
	W	X	Y	Z
A	18	24	28	32
B	8	13	17	18
C	10	15	19	22

6-b. Solve the game whose payoff matrix is given below: (CO3, K3)

6

Player A \ Player B	B1	B2	B3
A1	7	1	7
A2	9	-1	1
A3	5	7	6

7. Answer any one of the following:-

7-a. We have five jobs, each of which must go through the machine A,B and C in the

6

order ABC. (CO4, K3)

Job No.	1	2	3	4	5
Machine A	8	10	6	7	11
Machine B	5	6	2	3	4
Machine C	4	9	8	6	5

Determine a sequence for the jobs, that will minimize the total elapsed time and also calculate idle time.

- 7-b. Determine the order in which books should be processed, in order to minimize the total time required to turn out all the books. (CO4, K3) 6

Books	1	2	3	4	5	6
Printing time(hrs)	30	120	50	20	90	110
Binding time(hrs)	80	100	90	60	30	10

Find the idle time too.

8. Answer any one of the following:-

- 8-a. A project has the following time schedule: (CO5, K3) 6

Activity	1-2	1-3	1-4	2-5	3-6	3-7	4-6	5-8	6-9	7-8	8-9
Time in months	2	2	1	4	8	5	3	1	5	4	3

Construct a network diagram and find the critical path and time duration of the project.

- 8-b. The following table shows the jobs of a network along with their time estimates. The time estimates are in days. 6

Job	1-2	1-6	2-3	2-4	3-5	4-5	5-8	6-7	7-8
a	3	2	6	2	5	3	1	3	4
m	6	5	12	5	11	6	4	9	19
b	15	14	30	8	17	15	7	27	28

i) Draw the project network. ii) Find the critical path.

Also find the variance and standard deviation of project length. (CO5, K3)