

RAN-2411000802020001
M.Sc. (AI-ML) (Sem.-II) Examination April - 2026
202 - Optimization Techniques
Time: 3 Hours]
[Total Marks: 70
સૂચના : / Instructions

- (1) ઉપરોક્ત દર્શાવેલ વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the above details on your answer book

Seat No.:

Student's Signature
Q.1. A. Solve the following linear programming problem :
08

$$\text{Maximize } Z = 4x_1 + 6x_2 + 5x_3$$

Subject to :

$$x_1 + 2x_2 + x_3 \leq 50$$

$$3x_1 + 2x_2 + 4x_3 \geq 60$$

$$2x_1 + x_2 + 3x_3 \leq 70$$

$$x_1, x_2, x_3 \geq 0$$

OR
A. Solve the following linear programming problem :
08

$$\text{Maximize } Z = 8x_1 + 6x_2$$

Subject to:

$$4x_1 + 3x_2 \leq 120$$

$$2x_1 + x_2 \geq 30$$

$$x_1 + 2x_2 \leq 80$$

$$x_1, x_2 \geq 0$$

Q.1. B. A company is deploying AI models on cloud servers :
06

- Model X (Deep Learning)
- Model Y (Lightweight ML)

Resource usage per deployment :

- Model X : 5 GB RAM, 6 CPU units
- Model Y : 3 GB RAM, 2 CPU units

Available resources :

- RAM = 150 GB
- CPU = 120 units

Revenue :

- Model X = ₹ 1000
- Model Y = ₹ 600

Formulate the problem to maximize revenue using LPP.

Q.2. A. Obtain the optimum solution for the following transportation problem :

08

	App 1	App 2	App 3	App 4	Supply
Server A	5	8	6	6	35
Server B	4	7	7	5	50
Server C	8	6	9	7	40
Demand	30	20	30	45	

Q.2. B. Solve the following Assignment Problem. (*Task-GPU Assignment*)

06

	GPU 1	GPU 2	GPU 3	GPU 4	GPU 5
Task 1	7	9	8	6	5
Task 2	6	7	5	8	9
Task 3	8	6	9	7	6
Task 4	5	8	7	6	8
Task 5	9	7	6	5	7

Q.3. A. Four AI jobs are to be processed sequentially on **four machines (M1, M2, M3, M4)** in the same order. Each job must pass through all machines, and **no passing (preemption) is allowed.**

07

The processing times (in hours) are given below :

Job	M1	M2	M3	M4
J1	12	10	8	11
J2	10	9	7	10
J3	11	8	9	12
J4	9	7	6	8

Tasks :

1. Determine the optimal sequence of jobs using an appropriate method (e.g., **CDS method**).
2. Compute the **minimum total elapsed time (makespan)**.
3. Calculate the **idle time for each machine**.

OR

Q.3. A. Find an optimal sequence for the following sequencing problem of 5 jobs and 4 machines when passing is not allowed of which processing time (in hours) is given below :

07

Jobs	: 1	2	3	4	5
Machine M ₁	: 44	46	42	47	50
Machine M ₂	: 35	34	36	33	37
Machine M ₃	: 38	39	37	39	36
Machine M ₄	: 48	41	46	42	44

Also find the total elapsed time.

Q.3. B. Solve the following traveling salesman problem.

07

		To					
		1	2	3	4	5	6
From	1	∞	120	90	100	110	160
	2	120	∞	190	200	210	270
	3	90	190	∞	30	40	90
	4	100	200	30	∞	30	80
	5	110	210	40	30	∞	70
	6	160	270	90	80	70	∞

Q.4. A. Define the following terms :

04

1. Variance
2. Float
3. Critical Activity
4. Slack Time

B. The following activities are involved in an AI deployment project

10

Activity	Optimistic Time (a)	Most Likely Time (m)	Pessimistic Time (b)
1-2	1	4	13
1-3	2	5	14
2-4	2	6	14
2-5	3	7	15
3-5	4	6	10
4-6	3	5	11
5-6	5	9	17
5-7	2	4	10
6-8	4	8	16
7-8	3	6	15

Tasks :

1. Construct the network
2. Compute expected time & variance
3. Find critical path
4. Compute project duration
5. Find probability of completing project in **32 weeks**

OR

B. An **AI infrastructure setup project** consists of the following activities. Each activity has a normal duration, crash duration, and crash cost per day as given below :

Activity	Normal Time (days)	Crash Time (days)	Crash Cost per Day (₹)
1-2	8	5	40
1-3	6	4	30
2-4	5	3	20
3-4	7	5	25
4-5	9	6	35
5-6	6	4	30

The **indirect (overhead) cost** of the project is ₹ 60 per day.

Tasks :

1. Construct the network diagram for the project.
2. Determine the critical path and normal project duration.
3. Perform project crashing to determine:
 - o The optimum project duration
 - o The minimum total project cost (including direct and indirect costs)

- Q.5. A.** The annual demand for a cloud storage device is 4000 units. The ordering cost is Rs. 250 per order. The holding cost is 12% of the unit cost per year. The supplier offers the following price discounts :

04

Quantity Range	Unit Cost (Rs.)
$0 \leq Q < 500$	120
$500 \leq Q < 1000$	115
$1000 \leq Q < 2000$	110
2000 and above	105

Find the optimal order quantity that minimizes the total annual cost.

- B.** A machine shop produces three products 1,2 and 3 in lots. The shop has a warehouse whose total floor area is 275 sq. meters. The relevant data for the three items are given below :

05

Product	:	1	2	3
Annual demand (Units/year)	:	2500	2000	5500
Cost/ unit (Rs.)	:	8	12	3
Set-up cost per lot (Rs.)	:	95	170	80
Floor area required (sq. meters)	:	0.75	0.90	0.55

The carrying charge on each item is 25% of the average inventory valuation per annum. No stock outs are allowed. Determine the optimal lot size for each item.

- C.** A supplier provides electronic components at Rs. 30 per unit. The annual requirement is 3000 units. The cost of placing an order is Rs. 20 and the holding cost is Rs. 0.40 per unit per year. Determine the economic order quantity.

03

- D.** Define the following terms :

02

- | | |
|-------------------|-------------------|
| i. Reorder level, | ii. Holding cost, |
| iii. Inventory, | iv. Discount |