

(FOR THE CANDIDATES ADMITTED

SUBJECT CODE

24 UBC 4A1

DURING THE ACADEMIC YEAR 2024-25 ONLY)

REG.NO.

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI**END-OF-SEMESTER EXAMINATIONS : MAY– 2026****B.C.A.****MAXIMUM MARKS: 75****IV SEMESTER****TIME : 3 HOURS****PART – III****MATHEMATICS III - COMPUTER BASED OPTIMIZATION TECHNIQUES****SECTION – A****(10 X 1 = 10 MARKS)****ANSWER THE FOLLOWING QUESTIONS.****(K1)**

1. A variable used to convert $\leq$ inequality to equation is called as ____
(a) Surplus (b) Slack (c) Artificial (d) Basic
2. The assignment problem is said to be balanced if it is a ____ matrix
(a) Triangular (b) Unit (c) Rectangular (d) Square
3. If EOQ is calculated, but an order is then placed which is smaller than this, what will the variable cost ____
(a) increase (b) decrease (c) either increase or decrease (d) no change
4. The time required by each job on each machine is called ____ time.
(a) elapsed (b) idle (c) processing (d) average
5. The performance of a specific task in CPM, is known as ____
(a) Dummy (b) Event (c) Activity (d) Contract

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES.(Qn. No. 6 - 10) (K2)

6. How is the Big M method used in LPP?
7. What is an unbalanced case in an Assignment model?
8. When is the EOQ model most applicable?
9. What are the different types of sequencing problems?
10. Provide the basic difference between PERT and CPM.

SECTION – B (5 X 5 = 25 MARKS)**ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)**

11. a) A company has two grades of inspectors, I and II to undertake quality control inspection. At least 1,500 pieces must be inspected in an 8-hour day. Grade I inspector can check 20 pieces in an hour with an accuracy of 96%. Grade II inspector checks 14 pieces an hour with an accuracy of 92%. Wages of grade I inspector are Rs. 5 per hour while those of grade II inspector are Rs. 4 per hour. Any error made by an inspector costs Rs. 3 to the company. If there are, in all, 10 grade I inspectors and 15 grade II inspectors in the company, formulate a LPP to find the optimal assignment of inspectors that minimize the daily inspection cost.

(OR)

- b) Solve the following LPP graphically. Min $Z = 200x + 500y$ subject to,

$$x + 2y \geq 10, 3x + 4y \leq 24, x, y \geq 0.$$

(CONTD 2)

12. a) Determine an initial basic feasible solution to the following transportation problem using North West Corner Rule.

	D ₁	D ₂	D ₃	D ₄	Supply
O ₁	6	4	1	5	14
O ₂	8	9	2	7	16
O ₃	4	3	6	2	5
Required	6	10	15	4	35

(OR)

- b) From the following cost matrix, establish (a) optimal job assignment (b) the cost of assignments.

		Job				
		1	2	3	4	5
Machine	A	10	3	3	2	8
	B	9	7	8	2	7
	C	7	5	6	2	4
	D	3	5	8	2	4
	E	9	10	9	6	10

13. a) A particular item has a demand of 9,000 units per year. The cost of one procurement is Rs. 100/- and the holding cost per unit is Rs. 2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine: (a) Economic lot size, (b) The number of orders per year, (c) The time between orders, and (d) the total cost per year if the cost of one unit is Re.1/-.

(OR)

- b) A precision engineering company consumes 50,000 units of a component per year. The ordering, receiving and handling costs are Rs.3/- per order, while the trucking cost is Rs. 12/- per order. Further details are as follows: Interest cost Rs. 0.06 per units per year. Deterioration and obsolescence cost Rs.0.004 per unit per year. Storage cost Rs. 1000/- per year for 50,000 units. Calculate the economic order quantity, Total inventory carrying cost and optimal replacement period.
14. a) Find the optimal sequence that minimizes the total elapsed time required to complete the following tasks on two machines I and II in the order first on Machine I and then on Machine II.

Task:	A	B	C	D	E	F	G	H	I
Machine I (time in hours).	2	5	4	9	6	8	7	5	4
Machine II (time in hours).	6	8	7	4	3	9	3	8	11

(OR)

- b) Strong Book Binder has one printing machine, one binding machine, and the manuscripts of a number of different books. Processing times are given in the following table:

Book	Time In Hours	
	Printing	Binding
A	5	2
B	1	6
C	9	7
D	3	8
E	10	4

Determine the order in which books should be processed on the machines, in order to minimize the total time required.

(CONTD 3)

15. a) Develop a network diagram for the project specified below:

Event	Activity	Immediate Predecessor Activity
1→2	A	-
1→3	B	-
1→4	C	-
2→5	D	A
3→6	E	B
4→6	F	C
5→6	G	D

(OR)

- b) Draw the network diagram and determine the critical path for the following project:

Activity	1-2	1-3	1-4	2-5	3-6	3-7	4-7	5-8	6-8	7-9	8-9
Time estimate (Weeks)	5	6	3	5	7	10	4	2	5	6	4

SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) Use Simplex method to solve $\text{Min } Z = -6x_1 - 10x_2 - 4x_3$ subject to $x_1 + x_2 + x_3 \leq 1000$, $x_1 + x_2 \leq 500$, $x_1 + 2x_2 \leq 700$, $x_1, x_2, x_3 \geq 0$.

(OR)

- b) Use Big 'M' method to Maximize $z = 3x_1 + 2x_2$ subject to the constraints $2x_1 + x_2 \leq 2$, $3x_1 + 4x_2 \geq 12$, $x_1, x_2 \geq 0$.

17. a) Solve the following Transportation problem

		Destination				
Source		P	Q	R	S	Supply
	A	21	16	25	13	11
	B	17	18	14	23	13
	C	32	17	18	41	19
	Demand	6	10	12	15	43

(OR)

- b) The owner of a small machine shop has four mechanics available to assign jobs for the day. Five jobs are offered with expected profit for each mechanic on each jobs, which are as follows.

		Job				
		1	2	3	4	5
Mechanic	1	62	78	50	111	82
	2	71	84	61	73	59
	3	87	92	111	71	81
	4	48	64	87	77	80

By using the assignment method, find the assignment of mechanics to the job that will result in maximum profit.

(CONTD 4)

18. a) ABC manufacturing company purchases 9,000 parts of a machine for its annual requirement, ordering one month's usage at a time. Each part costs Rs. 20/-. The ordering cost per order is Rs. 15/- and the inventory carrying charges are 15% of the average inventory per year. You have been asked to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year?

(OR)

- b) (i) Compute the EOQ and the total variable cost for the data given below: Annual demand = $\lambda = 25$ units, Unit price = $p = \text{Rs. } 2.50$, Cost per order = Rs. 4/-, Storage rate = 1% Interest rate = 12%, Obsolescence rate = 7%.
- (ii) Compute the order quantity and the total variable cost that would result if an incorrect price of Rs. 1.60 were used for the item.
19. a) Find the solution of processing 5 jobs through 4 machines problem.

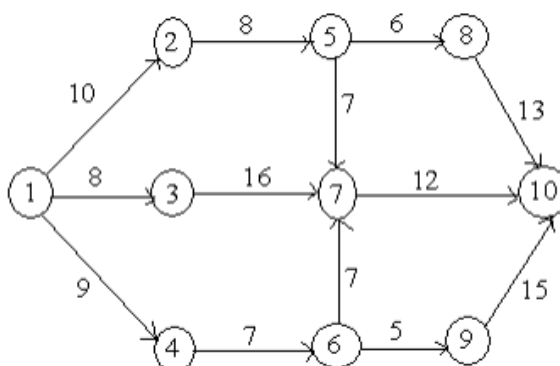
Job	1	2	3	4	5
Machine-1	11	13	9	16	17
Machine-2	4	3	5	2	6
Machine-3	6	7	5	8	4
Machine-4	15	8	13	9	11

(OR)

- b) There are 5 jobs each of which is to be processed on three machines A, B, and C in the order ACB. The time required to process in hours is given in the matrix below. Find the optimal sequence.

Job:	1	2	3	4	5
Machine A:	3	8	7	5	4
Machine B:	7	9	5	6	10
Machine C:	4	5	1	2	3

20. a) Determine the early start and late start in respect of all node points and identify critical path for the following network.



(OR)

- b) Distinguish between CPM and PERT analysis.