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VA—78—2024

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2024

(CBCS/New Pattern)

MATHEMATICS

Paper–XIV

(Operation Research)

(Friday, 13-12-2024)   **Time : 10.00 a.m. to 12.00 noon**

Time—2 Hours   *Maximum Marks—40*

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

1. Explain the major steps for mathematical formulation of linear programming problem and also obtain the rolls of paper having a fixed length and width of 180 cm. are being manufactured by a paper mill. These rolls have to be cut to satisfy the following demand :

Width :	80 cm	45 cm	27 cm
No. of Rolls :	200	120	130

P.T.O.

Obtain the L.P. formulation of the problem to determine the cutting pattern, so that the demand is satisfied and wastage of paper is a minimum.   15

Or

(a)   Define optimum solution and explain the standard form of linear programming problem.   8

(b)   Use the graphical method to solve the following LPP :   7

Minimize $Z = -x_1 + 2x_2$

Subject to the constraints :

$$-x_1 + 3x_2 \leq 10, \ x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2 \text{ and } x_1 \geq 0, \ x_2 \geq 0.$$

2.   Define basic solution and degenerate solution and obtain all the basic solutions to the following system of linear equation :   15

$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5$$

Or

(a)   Prove that a necessary and sufficient condition for the existence of a feasible solution so the general transportation problem is that :

Total supply = Total Demand i.e.   8

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j = \lambda \,(\text{say})$$

(b) The following is the cost matrix of assigning 4 clerks to 4 key punching jobs. 7

Find the optimal assignment if clerk 1 cannot be assigned job 1 :

Clerk	Job			
	1	2	3	4
1	–	5	2	0
2	4	7	5	6
3	5	8	4	3
4	3	6	6	2

What is the minimum total cost ?

3. Attempt any *two* of the following :

(a) Explain the linear programming problem consists of three components.

5

(b) Explain major steps LPP by graphical solution method. 5

(c) Show that the following system of linear equations has a degenerate solution : 5

$$2x_1 + x_2 - x_3 = 2$$

$$3x_1 + 2x_2 + x_3 = 3$$

(d) Explain the complete enumeration method and transportation method of assignment problem. 5