V/MAT (viii) (A)

2016

(5th Semester)

MATHEMATICS

Paper : MATH–354(A)

(Operations Research)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Two products *A* and *B* are to be manufactured. One unit of product *A* requires 2·4 minutes of punch press time and 5 minutes of assembly time. The profit for product *A* is ₹ 0·60 per unit. One unit of product *B* requires 3 minutes of punch press time and 2·5 minutes of

welding time. The profit for product *B* is ₹ 0·70 per unit. The capacity of the punch press department available for these products is 1200 minutes per week. The welding department has a capacity of 600 minutes per week and assembly department has 1500 minutes per week.

(i) Formulate the problem as linear programming problem.

(ii) Determine the quantities of products *A* and *B* so that the total profit is maximized. 5

(b) An agriculturist has a firm of 125 acres. He produces radish, muttar and potato. Whatever he raises is fully sold in the market. He gets ₹ 5 for radish per kg, ₹ 4 for muttar per kg and ₹ 5 for potato per kg. The average yield is 1500 kg of radish per acre, 1800 kg of muttar per acre and 1200 kg of potato per acre. To produce each 100 kg of radish, muttar and to produce each 80 kg of potato, a sum of ₹ 12·50 has to be used for manure. Labour required for each acre to raise the crop is 6 man-days for radish and potato each and 5 man-days for muttar. A total of 500 man-days of labour at the rate of ₹ 40 per man-day is available.

Formulate this as an LPP to maximize the agriculturist's total profit. 5

2. *(a)* A firm is engaged in breeding pigs. The pigs are fed on various products grown on the firm. In view of the need to ensure certain nutrient constituents (call them X, Y and Z), it is necessary to buy two additional products A and B. One unit of product A contains 36 units of X, 3 units of Y and 20 units of Z. One unit of B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirements of X, Y and Z are 108 units, 36 units and 100 units respectively. Product A costs ₹ 20 per unit and product B costs ₹ 40 per unit.

Formulate the above as a linear programming problem to minimize the total cost, and solve the problem by using graphic method. 5

(b) A diet is to contain at least 400 units of carbohydrate, 500 units of fat and 300 units of protein. Two foods A and B are available. A costs ₹ 2 per unit and B costs ₹ 4 per unit. A unit of food A contains 10 units of carbohydrate, 20 units of fat and 15 units of protein; a unit of food B contains 25 units of carbohydrate, 10 units of fat and 20 units of protein. Find the minimum

cost for diet that consists of a mixture of these two foods and also meets the minimum requirements. Formulate the problem as a linear programming problem and solve it. 5

UNIT—II

3. *(a)* Use simplex method to solve the following problem : 5

Maximize $Z \quad 2x_1 \quad 5x_2$

subject to

$$x_1 \quad 4x_2 \quad 24$$
$$3x_1 \quad x_2 \quad 21$$
$$x_1 \quad x_2 \quad 9$$

and $x_1, x_2 \quad 0$.

(b) A firm produces three types of biscuits A, B and C. It packs them in assortments of two sizes I and II. The size I contains 20 biscuits of type A, 50 of type B and 10 of type C. The size II contains 10 biscuits of type A, 80 of type B and 60 of type C. A buyer intends to buy at least 120 biscuits of type A, 740 of type B and 240 of type C. Determine the least number of packets he should buy. Use simplex method and concept of dual. 5

4. The following data are available for the firms which manufacture three items *A*, *B* and *C* products :

Product	*Time required* (in hour)		*Profit*
	Assembly	*Finishing*	
A	10	2	80
B	4	5	60
C	5	4	30
Firm capacity	2000	1009	

Find the optimum solution of the above data using simplex method. 10

UNIT—III

5. A company has four jobs *A*, *B*, *C* and *D* to be done on four machines *W*, *X*, *Y* and *Z*. Each job must be done on one and only one machine. The cost (in ₹) of each job on each machine is given in the following cost table :

Cost Table

Job	*W*	*X*	*Y*	*Z*
A	7	9	8	13
B	16	16	15	11
C	16	19	10	15
D	16	17	14	16

Using Hungarian method of assignment, determine the job assignments to the machine so as to minimize the total cost. 10

6. The following data describe a transportation problem :

From \ To	D_1	D_2	D_3	D_4	*Supply*
S_1	21	16	15	3	11
S_2	17	18	14	13	13
S_3	32	27	18	41	19
Demand	6	10	12	15	43 / 43

Find the initial solution by using—

(a) least cost method;

(b) Vogel's approximation method. 10

UNIT—IV

7. Use branch and bound technique algorithm to solve the following mixed integer problem : 10

Maximize $Z \quad 5x_1 \quad 4x_2$

subject to

$$x_1 \quad x_2 \quad 5$$
$$10x_1 \quad 6x_2 \quad 45$$

$x_1, x_2 \quad 0$ and integers

8. Use Gomory's cutting algorithm to solve the following problem : 10

Maximize $Z \quad 5x_1 \quad 7x_2$

subject to

$$2x_1 \quad 3x_2 \quad 6$$
$$6x_1 \quad x_2 \quad 30$$

$x_1, x_2 \quad 0$ and integers

UNIT—V

9. Solve the following game by the rule of dominance : 10

		Player B		
		I	*II*	*III*
Player A	*I*	4	6	3
	II	3	3	4
	III	2	3	4

10. Solve the game by graphical method, whose profit matrix is given below : 10

		Player B				
		B_1	B_2	B_3	B_4	B_5
Player A	A_1	5	5	0	1	8
	A_2	8	4	1	6	5

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Subject Code : V/ MAT (viii) (A)

Booklet No. A

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DEGREE 5th Semester
(Arts / Science / Commerce / .....) Exam., **2016**

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INSTRUCTIONS TO CANDIDATES

1. **The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
2. **This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.**
3. **While answering the questions of this booklet, any cutting, erasing, over-writing or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

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Roll No. .....
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Subject .....
Paper .....

Descriptive Type
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(5th Semester)

MATHEMATICS

Paper : MATH–354(A)

(Operations Research)

(PART : A—OBJECTIVE)

(*Marks* : 25)

Answer **all** questions

SECTION—I

(*Marks* : 10)

Each question carries 1 mark

Put a Tick ☑ mark against the correct answer in the box provided :

1. Objective function of an LPP is

(a) a constant ☐

(b) a function to be optimized ☐

(c) a relation between the variables ☐

(d) a variable ☐

2. An LPP must have

(a) objective that we aim to maximize or minimize ☐

(b) constraints that we need to be specify ☐

(c) decision variables that we need to be determine ☐

(d) All of the above ☐

3. In a simplex method, if there is tie between a decision variable and a slack (or surplus) variable, then

(a) decision variable should be selected ☐

(b) slack variable should be selected ☐

(c) surplus variable should be selected ☐

(d) All of the above ☐

4. At any iteration of the usual simplex method, if there is at least one basic variable in the basis at zero level and all $z_j \quad c_j \quad 0$, the current solution is

(a) infeasible ☐

(b) unbounded ☐

(c) non-degenerate ☐

(d) degenerate ☐

5. The dual of the primal maximization LPP having *m* constraints and *n* non-negative variables should

(a) be a minimization LPP ☐

(b) have *n* constraints and *m* non-negative variables ☐

(c) Both *(a)* and *(b)* ☐

(d) be a maximization LPP ☐

6. The transportation problem deals with the transportation of

(a) a single product from several sources to a destination ☐

(b) a multiproduct from several sources to several destinations ☐

(c) a single product from a source to several destinations ☐

(d) a single product from several sources to several destinations ☐

7. In a mixed integer programming problem

(a) only few of the decision variables require integer solutions ☐

(b) different objective functions are mixed together ☐

(c) all of the decision variables require integer solution ☐

(d) None of the above ☐

8. While solving an IPP, any non-integer variables in the solution is picked up to

(a) enter the solution ☐

(b) leave the solution ☐

(c) obtain the cut constraints ☐

(d) All of the above ☐

9. A game is said to be fair, if

(a) upper and lower values of the game are same and zero ☐

(b) upper and lower values of the game are not equal ☐

(c) upper value is more than lower value of the game ☐

(d) None of the above ☐

10. Consider the game *G* of the following payoff matrix :

		Player B
Player A	3	8
	3	

Then the value of the game *G* is

(a) 3 ☐

(b) 3 ☐

(c) 8 ☐

(d) 3 24 ☐

SECTION—II

(*Marks* : 15)

Each question carries 3 marks

1. Express the following LPP in the standard form :

Maximize $Z \quad 3x_1 \quad 5x_2 \quad 2x_3$

subject to

$$x_1 \quad 2x_2 \quad x_3 \quad 4$$
$$5x_1 \quad 6x_2 \quad 7x_3 \quad 5$$
$$2x_1 \quad x_2 \quad 3x_3 \quad 10$$

$x_1, x_2 \quad 0, x_3$ unrestricted in sign

2. Define pivot column and pivot row. How do you derive a new tableau?

3. Obtain the dual problem from the following LPP :

Minimize $Z \quad 2x_1 \quad 5x_2$

subject to the constraints

$$x_1 \quad x_2 \quad 2$$
$$2x_1 \quad x_2 \quad 6x_3 \quad 6$$
$$x_1 \quad x_2 \quad 3x_3 \quad 4$$

and $x_1, x_2, x_3 \quad 0$

4. Distinguish between pure and mixed integer programming problems.

5. Solve the game whose payoff matrix is

		Player B		
Player A		15	2	3
		6	5	7
		7	4	0

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