

B.Sc. (With Credits)-Regular-Semester 2012 Sem V  
**B.Sc.3530 - Mathematics-II Paper-III (Optional) :**  
**Linear Programming and Transportation Problems**

P. Pages : 4

Time : Three Hours



GUG/W/16/3372

Max. Marks : 60

- Notes :
1. Solve all **five** questions.
  2. Q. 1 to Q. 4 have an alternative solve each question in full or its alternative in full.
  3. All questions carry equal marks.

**UNIT – I**

1. a) A person wants to decide the constituents of a diet which will fulfil his daily requirement of proteins, fats and carbohydrates at the minimum cost. The choice is to be made from four different types of foods. The yields per unit of these foods are given in table. 6

Food type	Yield per unit			Cost per unit (Rs.)
	Proteins	Fats	Carbohydrates	
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Minimum requirement	800	200	700	

- b) Use graphical method to solve the problem. 6

$$\begin{aligned} &\text{Maximize } z = 2x_1 + x_2 \\ &\text{Subject to } \quad x_1 + 2x_2 \leq 10 \\ &\quad \quad \quad x_1 + x_2 \leq 6 \\ &\quad \quad \quad x_1 - x_2 \leq 2 \\ &\quad \quad \quad x_1 - 2x_2 \leq 1 \\ &\quad \quad \quad x_1, x_2 \geq 0 \end{aligned}$$

**OR**

- c) Express the following L.P.P. in standard form. Determine  $x_1, x_2, x_3$  as to 6

$$\begin{aligned} &\text{Maximize } z = 3x_1 + 2x_2 + 5x_3 \\ &\text{Subject to } \quad 2x_1 + 3x_2 - 2x_3 \leq 40 \\ &\quad \quad \quad 4x_1 - 2x_2 + x_3 \leq 24 \\ &\quad \quad \quad x_1 - 5x_2 - 6x_3 \geq 2 \\ &\quad \quad \quad x_1 \geq 0 \end{aligned}$$

- d) Prove that intersection of two convex set is convex. 6

**UNIT – II**

2. a) Use simplex method to solve the following problem. 6  
 Maximize  $z = 2x_1 + 5x_2$   
 Subject to  $x_1 + 4x_2 \leq 24$   
 $3x_1 + x_2 \leq 21$   
 $x_1 + x_2 \leq 9$   
 $x_1, x_2 \geq 0$

- b) Find all basic feasible solutions of the equations 6  
 $2x_1 + 6x_2 + 2x_3 + x_4 = 3$   
 $6x_1 + 4x_2 + 4x_3 + 6x_4 = 2$

**OR**

- c) Explain Big M-method. 6  
 d) Use the two phase simplex method to. 6  
 Maximise  $z = 5x_1 - 4x_2 + 3x_3$   
 Subject to  $2x_1 + x_2 - 6x_3 = 20$   
 $6x_1 + 5x_2 + 10x_3 \leq 76$   
 $8x_1 - 3x_2 + 6x_3 \leq 50$   
 $x_1, x_2, x_3 \geq 0$

**UNIT – III**

3. a) Explain North West Corner rule. 6  
 b) Find initial basic feasible solution to a transportation problem using NWCR. 6

Plants (Origin)		Distribution Centres (Destination)				Supply
		1	2	3	4	
1	2	3	11	7	6	
2	1	0	6	1	1	
3	5	8	15	9	10	
Requirements		7	5	3	2	17

**OR**

- c) Find an initial basic feasible solution to the transportation problem using Vogel's approximation method. 6

Factories	Ware house				Factory capacity
	w <sub>1</sub>	w <sub>2</sub>	w <sub>3</sub>	w <sub>4</sub>	
f <sub>1</sub>	19	30	50	10	7
f <sub>2</sub>	70	30	40	60	9
f <sub>3</sub>	40	8	70	20	18
Factory requirement	5	8	7	14	

d) Explain transportation algorithm.

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#### UNIT – IV

4. a) Four different jobs can be done on four different machines. The setup and take down time costs are assumed to be prohibitively high for changeovers. The matrix below gives the cost in rupees of producing job  $i$  on machine  $j$ .

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	$M_1$	$M_2$	$M_3$	$M_4$
$J_1$	5	7	11	6
$J_2$	8	5	9	6
$J_3$	4	7	10	7
$J_4$	10	4	8	3

How should the jobs be assigned to the various machines so that the total cost is minimized? Also formulate the mathematical model for the problem.

- b) Find the optimal solution for the Assignment problem with following cost matrix.

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	I	II	III	IV	V
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	15

#### OR

- c) Explain algorithm of Hungarian method.

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- d) A departmental head has four tasks to be performed with three subordinates who differ in efficiency. The estimates of time each subordinates will take to perform is given below in the matrix. How should he allocate the tasks one to each man so as to minimise the total man hours?

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Task	Man		
	1	2	3
I	9	26	15
II	13	27	6
III	35	20	15
IV	10	30	20

5. Solve any six.

- a) Define extreme points of convex set.

2

- b) Define the term :

2

- i) Non degenerate basic feasible solution.  
ii) Degenerate basic feasible solution.

- c) Define the term : 2  
i) Slack variable.  
ii) Surplus variable.
- d) Explain the term 'Artificial Variables'. 2
- e) What do you understand by Balanced and unbalanced transportation problem? 2
- f) What are the condition for optimality test in case of Transportation problem? 2
- g) What is optimality criterion in a assignment problem? 2
- h) Write mathematical formulation of Assignment problem. 2

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