

**B.Com. (Hons.) II Year Annual Mode**  
**Business Mathematics**  
**Code : B-104**

पूर्णांक : 100  
M.M. : 100

*Attempt any two questions in all.*  
*All questions carry equal marks.*

किन्हीं दो प्रश्नों के उत्तर दो।  
सभी प्रश्नों के अंक समान हैं।

(Write your Name and Roll No. on each page of your answer sheet.)  
(अपनी उत्तर पुस्तिका के प्रत्येक पृष्ठ पर अपना नाम और रोल नंबर लिखें।)

- 1(a) A manufacturer produces three products X, Y and Z which he sells in three markets I, II and III. Monthly sales and sale prices are given as follows:

Market	Items Sold			Sale Price (Rs.)		
	X	Y	Z	X	Y	Z
I	10000	15000	20000	2.00	3.00	4.00
II	20000	28000	30000	2.50	2.80	3.70
III	30000	35000	40000	2.30	3.10	4.20

The cost per item for three products X, Y and Z are Rs. 1.80, Rs. 2.50 and Rs. 3.40 respectively. Find by matrix algebra the total profit of the manufacturer.

- 1(b) A firm has two production centres S1 and S2 with respective production of 200 and 100 units. It has four distribution centres D1, D2, D3 and D4 with demand of 75, 100, 100 and 30 units respectively. The delivery cost per unit of transportation from different production centres to different distribution centres is given below:

Production Centres	Distribution Centres			
	D1	D2	D3	D4
S1	90	90	100	100
S2	50	70	130	85

Find the optimum solution so as to minimize the transportation cost.

- 1(c) An economy produces only coal and steel. The two commodities serve as intermediate inputs in each other's production. 0.4 tonne of steel and 0.7 tonne of coal are needed to produce a tonne of steel. Similarly, 0.1 tonne of steel and 0.6 tonne of coal are required to produce a tonne of coal. No capital inputs are needed. Do you think that the system is viable?

2 and 5 labour days are required to produce a tonne of coal and steel respectively. If the economy needs 100 tonne of coal and 50 tonne of steel, calculate the gross output of the two commodities and total labour required. Also determine the equilibrium prices and the value added if the wage rate is Rs. 10 per man-day.

*Assignment*

- 2(a) The standard weight of a special purpose brick is 5 kg and it contains two basic ingredients B<sub>1</sub> and B<sub>2</sub>. B<sub>1</sub> costs Rs. 5 per kg and B<sub>2</sub> costs Rs. 8 per kg. Strength considerations dictate that the brick contains not more than 4 kg of B<sub>1</sub> and minimum of 2 kg of B<sub>2</sub>. Since the demand for the product is likely to be related to the price of the brick, find the minimum cost of the brick satisfying the above condition.
- 2(b) A firm uses three machines in the manufacture of three products. Each unit of product A requires 3 hours on Machine I, 2 hours on Machine II and 1 hour on Machine III. Each unit of product B requires 4 hours on Machine I, 1 hour on Machine II and 3 hours on Machine III. Each unit of product C requires 2 hours on each of the three machines. The contribution margin of the three products is Rs. 30, Rs. 40 and Rs. 35 per unit respectively. The machine hours available on the three machines are 90, 54 and 93 respectively.
- Formulate the above as a linear programming problem and solve for maximum profit, using Simplex method.
  - Write the dual to the above problem.
  - Find the optimum values of the dual variables and verify that the primal and the dual problems have the same objective function values.
- 3(a) A firm requires 10000 units of a material per annum. The cost of purchasing is Re. 1 per unit, the cost of replenishment of stock of material is Rs. 25 and the cost of storing material is 12.5 per cent per annum of the average rupee inventory. Find the optimum order size and the corresponding total cost using calculus.
- 3(b) A production function is given by  $Q = f(L, K) = 27L^{2/3}K^{1/3}$ , where L is labour and K is capital.
- Find the behavior of the marginal product of each factor.
  - What is the nature of returns to scale?
  - What is the total reward of labour and capital if each factor is paid a price equal to its marginal product?
- 3(c) Find the consumers' surplus and producers' surplus under pure competition for demand function  $p = \frac{8}{x+1} - 2$  and supply function  $p = \frac{1}{2}(x+3)$ , where  $p$  is price and  $x$  is quantity.
- 4(a) Mohit deposited Rs. 1,00,000 in a bank for 3 years offering interest rate of 6% compounded half- yearly during first year, at the rate of 12% compounded quarterly during second year and at 10% compounded continuously during third year. Find his balance after 3 years.
- 4(b) A loan of Rs 10,000 is to be repaid by equal annual installments of principal and interest over a period of 20 years. The rate of interest is 3% per annum effective. Find:
- The annual installment;
  - The capital contained in 8<sup>th</sup> installment; and
  - The principal repaid after 12 installments have been paid.
- 4(c) Suggest optimal assignment for four salesmen to sales territories where the estimated sales in lakhs of rupees to be made by each of the salesman in different sales territories are given below. Also find total maximum sales.

*Assignment*

<b>Salesman</b>	<b>Territories</b>				
	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>
A	16	15	17	10	8
B	16	16	20	15	12
C	12	8	10	13	15
D	18	16	17	12	10