

2/H-76 (v) (a) (Syllabus-2019)

2 0 2 2

(May/June)

COMMERCE

(Honours)

(Fundamental Mathematics)

(BC-202)

(Under Revised Syllabus)

Marks : 75

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—I

- 1. (a) Solve the following by Cramer's rule : 5**

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$$

$$\frac{2}{x} + \frac{5}{y} + \frac{3}{z} = 0$$

$$\frac{1}{x} + \frac{2}{y} + \frac{4}{z} = 3$$

(2)

- (b) Solve the following equations using matrix inversion method :

5

$$3x + 4y + 5z = 18$$

$$2x - y + 8z = 13$$

$$5x - 2y + 7z = 20$$

- (c) Find the value of the determinant

$$\begin{vmatrix} a & b & 0 \\ c & 0 & a \\ 0 & c & b \end{vmatrix}$$

and then express its square as a third-order determinant. What is its value?

5

Or

- (a) In a certain city, there are 5 colleges and 20 schools. Each school has 3 peons, 1 clerk, 1 head clerk whereas a college has 5 peons, 3 clerks, 1 head clerk and 1 caretaker as additional staff. The monthly salary of each of them is given as :

Peon = ₹ 11,000; Clerk = ₹ 17,000; Head clerk = ₹ 30,000; Caretaker = ₹ 25,000

Find the total monthly salary bill of each school and college using matrix.

5

22D/627

(Continued)

(3)

- (b) Using properties of determinants, prove that

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = -(a^3 + b^3 + c^3 - 3abc)$$

and hence show that

$$\begin{vmatrix} 2bc - a^2 & c^2 & b^2 \\ c^2 & 2ac - b^2 & a^2 \\ b^2 & a^2 & 2ab - c^2 \end{vmatrix} = (a^3 + b^3 + c^3 - 3abc)^2$$

5

- (c) Consider the following matrix of transition of a product available in the market on two brands :

	Brand A	Brand B
Brand A	0.8	0.2
Brand B	0.4	0.6

Determine the market share of each brand in an equilibrium position.

5

UNIT—II

2. (a) Mr. A has built a new rental unit of 40 rooms. It is known that if a rent of ₹ 1,500 per day is charged, for each room, all the rooms will be occupied. For an increase of ₹ 50 in rent per room, one room will remain vacant. What daily rent should be charged for each room to obtain the maximum daily total rental revenue? Find the maximum daily total revenue.

7

22D/627

(Turn Over)

(4)

- (b) The annual profit in ₹, $P(x)$, of a manufacturer from the sale of an electronic item is given by

$$P(x) = 1,00,000 + 50,000e^{-0.2x}$$

where x is the number of years the electronic item has been in the market. Find the manufacturer's profit for $x = 7$. It is given that $e = 2.7183$ (approx).

4

- (c) State the characteristics of exponential function.

4

Or

- (a) A company has introduced production bonus to its employees that increases the cost of spare parts it produces. The daily cost function C for x number of spare parts produced is given by

$$C(x) = ₹20 \cdot 50x + 5500$$

- (i) If each spare part is sold for ₹30, determine the minimum number that must be produced and sold daily to reach break-even point.
 (ii) If the selling price is increased by ₹3 per piece, what would be the break-even point?
 (iii) If it is known that at least 500 pieces can be sold daily, what price the company should charge per piece to guarantee no loss?

6

(5)

- (b) If α and β are the roots of the equation

$$x^2 - px + q = 0$$

form the equation whose roots are $\alpha + \frac{1}{\beta}$

and $\beta + \frac{1}{\alpha}$.

5

- (c) State the characteristics of logarithmic functions.

4

UNIT—III

3. (a) State the properties of limits.

5

- (b) Differentiate $y = \frac{x^2 + 1}{x - 1}$ w.r.t. x .

5

- (c) Show that $f(x) = 3x^2 + 2x - 1$ is continuous at $x = 2$. Hence, prove that $f(x)$ is continuous for all values of x .

5

Or

- (a) Find from first principle, the value of derivative of x^n , where n is any number.

5

- (b) State the standard rules of differentiation.

5

- (c) Find the first derivative of $\frac{e^x}{1+x}$.

5

UNIT—IV

4. (a) Given the demand function is $p = 46 - 3x$ and cost function is $C = 110 + 6x + \frac{x^2}{2}$. Find the number of units and the price at which the total profit is maximum. Calculate the maximum profit. 5
- (b) A company has a demand curve $x = 106 - 2p$ and average cost curve $AC = 50 + \frac{x}{50}$, where p is the price per unit of output and x is the number of units of output. If the total revenue is $R(x) = xp$, determine the most profitable output and the maximum profit. 5
- (c) Determine the price elasticity of demand for the function $p = (a - bx)^2$. 5

Or

- (a) A firm produces x metric tonnes of output at a total cost

$$C(x) = ₹ \left(\frac{x^3}{10} - 6x^2 + 70x + 11 \right)$$

Determine in terms of x , (i) the average cost, (ii) the average variable cost and (iii) the average fixed cost. Find the value of each of these at the level of output of 10 metric tonnes. 5

- (b) If AR and MR denote the average and marginal revenue at any output level, show that the elasticity of demand is equal to $\frac{AR}{AR - MR}$. Also, verify this for the linear equation $p = a + bx$. 4
- (c) The annual material demand is 10000 units, the cost price of raw material is ₹ 1 per unit and it costs ₹ 25 to make the factory ready for production run. Regardless of the number of units x produced in a run and the annual cost of storing the material is 12.50% of the rupee value of the average inventory. Show that Total Cost
- $$TC = 10000 + \frac{250000}{x} + \frac{x}{16}$$
- What is the economic order quantity and the total cost corresponding to that? Also, find the total cost when each order is placed for 2500 units. 6

UNIT—V

5. (a) Mr. X has deposited a sum of ₹ 5,00,000 in two different banks A and B, dividing the amount in two investments. Bank A gives interest at 7% p.a. and Bank B offers interest at 6% p.a. convertible semiannually. At the end of 3 years, he received ₹ 1,06,322.50 as the return on his investment. What amount he has deposited in each of the Bank A and Bank B? 5

- (b) Calculate the effective rate of interest equivalent to the nominal rate 8% converted (i) semiannually, (ii) quarterly, (iii) monthly and (iv) continuously. 5
- (c) At the beginning of each month, a sum of ₹ 5,000 is deposited in an account opened in a post office at 12% p.a. compounded monthly. Find the balance in the account at the end of 8 years. Also, calculate the total interest earned from these investments. 5

Or

- (a) A debt of ₹ 30,000 which is due in 6 years from now is preferred to be paid off by three installments :

₹ 5,000 now; ₹ 15,000 in 3 years
and final payment of ₹ 4,750 at the
end of n years

The rate of interest is 6% effective. Find the value of n . 5

- (b) Find the nominal rate of discount convertible continuously that is equivalent to the effective rate of discount at 7%. 5

- (c) Mr. P purchases a car on installment basis such that ₹ 1,00,000 each payable at the end of every year for 20 years and a final payment of ₹ 5,00,000 one year later. If the rate of interest is 9% p.a. compounded annually, find the cash down price of the car. 5

★ ★ ★