

Gauhati University B.Com 4<sup>th</sup> Semester (Sem-4/CBCS) HC 2 (BMT)

2022

COMMERCE

(Honours)

Paper : COM-HC-4026

(Business Mathematics)

Full Marks : 80

Time : Three hours

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

**1. Answer the following questions as directed: (any ten) 1 x 10 = 10**

(i) Define a diagonal matrix.

(ii) Find the value of x, if

$$\begin{vmatrix} 4 & 5 \\ x & 9 \end{vmatrix} = -4$$

(iii) If  $f(x) = 2x^2 + 3x + 2$ , find the value of  $f(-3)$ ,

(iv) Evaluate:

$$\int_1^3 \frac{1}{x} dx$$

(v) Define a sinking fund.

(vi) 10 % profit on S.P. = \_\_\_% profit on C.P. (Fill in the blank)

**(vii) Write True or False:**

Every diagonal matrix is a scalar matrix.

(viii) Define trade discount.

(ix) If  $a$  is the first term and  $d$  is the common difference of an A.P. series, then the  $n$ th term is \_\_\_\_\_ (Fill in the blank)

(x) Find the cofactor of -1 in the following determinant :

$$\begin{vmatrix} 2 & -3 & 5 \\ 5 & 2 & 7 \\ -4 & 2 & -1 \end{vmatrix}$$

(xi) What is the difference between simple interest and compound interest?

(xii) Find the fourth proportional to 9 m, 17 m and ₹36.

(xiii) Define 'objective function' associated with linear programming.

(xiv)  $\frac{d}{dx} (TC) = ?$  where x denote the volume of output (Fill in the blank)

(xv)  $\frac{d}{dx} \sqrt{x^2 + 5} = ? ?$

**2. Answer the following questions: (any five)  $2 \times 5 = 10$**

(i)

If

$$A = \begin{bmatrix} 2 & 0 & 4 \\ 6 & 2 & 8 \\ 2 & 4 & 6 \end{bmatrix}, B = \begin{bmatrix} 8 & 4 & -2 \\ 0 & -2 & 0 \\ 2 & 2 & 6 \end{bmatrix}, \text{ find}$$

the matrix  $3A + 2B$ .

(ii) If  $F(X) = \frac{1}{1+X}$  then find  $f\{f(x)\}$ .

(iii) Which term of the series 10, 4, -2, -8, ... is -104 ?

(iv) Find the compound ratio of the following:

$$2:3, 6:7, 8:9$$

(v) The ratio between two numbers is 2:7. If each of them is increased by 14, the ratio between the new numbers obtained become 4:7. Find the original numbers.

(vi) Define

(a) Immediate annuity

(b) Perpetual annuity

(vii) Mr. bought a cycle for ₹ 2,000 and sold it for ₹ 1,800 due to some damage. Find his profit or loss per cent.

(viii) At what rate of simple interest per annum will ₹ 1,500 produce the same interest in 5 years as ₹ 3,125 produce in 3 years at 4% per annum?

**3. Answer any four questions from the following:  $5 \times 4 = 20$**

(i) If  $A = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

Show that

$$(A + B)^2 \neq A^2 + 2AB + B^2$$

(ii) Solve:

$$\begin{vmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{vmatrix} = 0$$

(iii) If  $x, y, z$  be the  $p^{th}, q^{th}$  and  $r^{th}$  th term respectively of an A.P., then prove that

$$x(q - r) + y(r - p) + z(p - q) = 0$$

(iv) Insert 5 geometric mean between 9 and 576 .

(v) Discuss the basic assumptions of linear programming.

(vi) Compound interest for 2 nd year on a certain sum at 4% per annum is ₹ 25 .

Find the C.I. for 3rd year.

(vii) Dinesh finished  $\frac{3}{5}$  th of the work in 9 days and the remaining work he finished in 4 days with the assistance of Rajeev. Find in how many days Rajeev alone can finish it.

$$\lim_{x \rightarrow 1} \frac{(x^2 - 1)}{\sqrt{3xx + 1} - \sqrt{5 - 1}} = -4$$

OR

Evaluate:

$$\lim_{x \rightarrow 1} \frac{\sqrt{1 + 2x} - \sqrt{1 - 3x}}{x}$$

Answer any four questions from the following:  $10 \times 4 = 40$

4. (a) Solve the following system of equation by Cramer's rule :

$$3x + y + 2z = 3$$

$$2x - 3y - z = -3$$

$$x + 2y + z = 4$$

(b) Prove that :

$$\begin{vmatrix} 1+a & b & c \\ a & 1+b & c \\ a & b & 1+c \end{vmatrix} = 1+a+b+c$$

(c) Evaluate:

$$\begin{vmatrix} 2 & -3 \\ 4 & 7 \end{vmatrix} + \begin{vmatrix} -1 & -2 \\ 4 & -6 \end{vmatrix}$$

5. (a) Construct a  $3 \times 2$  matrix such that

$$a_{ij} = \frac{3i}{i+j}$$

(b) If  $A = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$ , then show that

$$A^2 = 7A - I$$

$$\text{Where } I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

(c) A man buys 8 dozen of mangoes (a) ₹ 18 per dozen, 10 dozen of apples (a) 9 per dozen and 4 dozen of bananas (a) ₹ 6 per dozen. Represent the quantities bought by row matrix and prices by column matrix and hence find the total cost.

6. (a) The sum of three numbers in A.P. is 54 and the product of the two extremes is 275 . Find the numbers.

(b) Find the value of  $k$  such that  $3k - 7, 5k - 1, 14k + 2$  are in G.P. 2

(c) If  $x, y, z$  are in A.P. and  $x^b, y^c, z^a$  are in G.P., prove that,

$$x^{b-c} y^{c-a} z^{a-b} = 1$$

7. (a) The compound interest and simple interest on a certain sum of money at a certain rate for 2 years are respectively at ₹ 920.95 and ₹ 900 . Find the rate and the sum. 5

(b) A person sells 4% stock of ₹ 17,500 and invests the proceeds in 3% stock at  $74\frac{7}{8}$ . If his income increases by ₹ 17.50 , find the selling price of 4% stock (brokerage being  $\frac{1}{8}\%$  in each case).

8. (a) A true discount on a bill of ₹ 1,01,000 is ₹ 1,000 at 5% p.a. Find how many days prior to the actual due date was the bill discounted.

**(b) Define:  $1+1=2$**

(i) Dividends

(ii) Market value of a share

(c) Which is a better investment-4% stock at 82 or  $4\frac{1}{2}\%$  stock at 95? 3

9. (a) A person buys an article and sells at a profit of 5%. If he had bought it at 5% less price and sold it for 37 paise less, he would have gained 10%. Find the original cost price.

(b) In mixing two types of tea, 2% is wasted. In what ratio tea costing ₹ 60 per kg be mixed with tea costing ₹ 45 per kg, so that by selling the mixture at ₹ 62.50 per kg, there is a gain of 25% on total outlay.

10. If  $f(x) = \frac{1}{x}$ ,

Show that

$$f(p) - f(q) = f\left(\frac{pq}{q-p}\right)$$

(b) Examine the continuity of the following function at  $x = 3$ . 3

$$f(x) = \begin{cases} \frac{x^2-9}{x-3}, & \text{if } x \neq 3 \\ 6, & \text{if } x = 3 \end{cases}$$

(c) Find the

(i) average revenue function (AR), and

(ii) marginal revenue function (MR) for the following total revenue function (TR) and evaluate them at  $x = 3$ . 5

$$TR = Q^3 - \frac{Q^2}{3} + 27Q$$

**11. (a) Find the differential co-efficient of  $\frac{1}{x^2}$  using first principle. 5**

(b) Find the maximum and minimum

values of  $2x^3 - 9x^2 + 12x - 1$  5.

(a) Integrate:  $2 + 3 = 5$

(i)  $\int (3x + 2)^2 dx$

$$(ii) \int \frac{x^3 + 5x^2 - 4x + 2}{x^2} dx$$

$$(b) \text{ Evaluate ; } 2\frac{1}{2} + 2\frac{1}{2} = 5$$

$$(i) \int_1^2 \left( \frac{x^2 + 2x + 5}{x} \right) dx$$

$$(ii) \int_1^4 \left( \sqrt{x} + \frac{1}{\sqrt{x}} \right) dx$$

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