**TDC (CBCS) Even Semester Exam., 2022**

# COMMERCE

## ( Honours )

**( 4th Semester )**

Course No. : COMHCC-402T

**( Business Mathematics )**

*Full Marks* : 70
*Pass Marks* : 28

*Time* : 3 hours

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

SECTION—A

Answer any *ten* questions of the following : 2×10=20

**1.** If

$$A = \begin{bmatrix} 1 & 5 \\ 3 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & -1 \\ 5 & 2 \end{bmatrix}$$

find $2A + 3B$

**2.** Define diagonal matrix and null matrix.

**3.** If

$$A = \begin{bmatrix} 0 & 0 \\ 5 & 0 \end{bmatrix}$$

show that $A^2 = 0$.

**4.** If $f(x) = x^2$, find $f\{f(3)\}$.

**5.** Find the value of

$$\lim_{x \to 2} \frac{x^2 + 2x - 2}{2x + 3}$$

**6.** Distinguish between $\lim_{x \to a} f(x)$ and $f(a)$.

**7.** If $u = x^2 + y$, find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$.

**8.** State Euler's theorem.

**9.** Find the total differential of $u = x^2 + 2y^2$.

**10.** Define annuity.

**11.** Calculate the SI on ₹ 5,000 for 2 years at the rate of 4% p.a.





**12.** Calculate compound interest of ₹ 2,000 at 5% p.a. for 3 years.

**13.** What is meant by linear programming problem?

**14.** Write the two assumptions of a linear programming problem.

**15.** What are slack and surplus variables?

## SECTION—B

Answer any *five* questions of the following : 10×5=50

**16.** *(a)* Find adj $A$ where

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{bmatrix}$$

5

*(b)* If

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

show that $A^2 - 4A - 5I = 0$. 5

**17.** *(a)* Find the inverse of the following matrix : 5

$$A = \begin{bmatrix} 2 & 2 & 3 \\ 1 & -2 & 3 \\ 0 & 1 & -1 \end{bmatrix}$$

*(b)* If

$$A = \begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}, \; B = \begin{bmatrix} 2 & x \\ 0 & -\frac{1}{2} \end{bmatrix}$$

find the value of $x$ if $AB = BA$. 5

**18.** *(a)* *(i)* Evaluate the following : 3

$$\lim_{x \to 3} \frac{x^2 - 5x + 6}{x - 3}$$

*(ii)* When is a function said to be continuous at a point? 2

*(b)* *(i)* If

$$f(x) = \begin{cases} 4x + 3 & \text{for } x \neq 4 \\ 3x + 7 & \text{for } x = 4 \end{cases}$$

find whether the function is continuous at $x = 4$. 2

*(ii)* Find $\frac{dy}{dx}$, $y = \log(ax + b)$. 3





**19.** *(a)* Find $\frac{dy}{dx}$ (any *two*) : 2½×2=5

*(i)* $y = (x^2 + 5x)^3$

*(ii)* $2x^2 + 5xy + 3y^2 = 1$

*(iii)* $y = e^x + \log x$

*(b)* *(i)* Find the maximum and minimum values of $2x^3 - 15x^2 + 36x + 10$.

*(ii)* Given the total cost function $C = Q^3 - 2Q^2 + 3Q + 35$, find the marginal cost when $Q = 3$. 3+2=5

**20.** *(a)* If

$$u = \log\left(\frac{x^2 + y^2}{x + y}\right)$$

show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$. 4

*(b)* *(i)* Verify Euler's theorem for the function $u = ax^2 + by^2 + 2hxy$. 3

*(ii)* Find the total derivative of $u$ with respect to $t$, $u = x^2y^2$, $x = t^3$, $y = t^3 + 3$. 3

**21.** *(a)* Evaluate the following (any *two*) : 3×2=6

*(i)* $\int\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^2 dx$

*(ii)* $\int x^2 e^x dx$

*(iii)* $\int(x^3+e^x+10\log x)dx$

*(b)* The marginal cost function of a firm is $2+3e^x$, where $x$ is the output. Find the average total cost function, if the fixed cost is ₹ 500. 4

**22.** *(a)* In what time will a sum of money double itself at 5% p.a. CI? 3

*(b)* What sum will buy an annuity of ₹ 1,050 payable for 4 years, the rate of interest being $3\frac{1}{2}$% p.a. compound interest? 4

*(c)* At SI, a principal amounts to ₹ 2,800 in 2 years and ₹ 3,250 in 5 years. Find the principal and rate of interest. 3

**23.** *(a)* What sum will buy an annuity of ₹ 1,050 payable for 4 years, the rate of interest being $3\frac{1}{2}$% p.a. compound interest. 5

*(b)* In how many years the simple interest on ₹ 800 at 3% p.a. will be ₹ 72? 5





**24.** *(a)* Discuss briefly the applications of linear programming in commerce. 4

*(b)* Solve the following LPP using graphical method :

Maximize $Z = 6x_1 + 8x_2$

subject to

$$5x_1 + 10x_2 \le 60$$
$$4x_1 + 4x_2 \le 40$$
$$x_1, x_2 \ge 0$$ 6

**25.** *(a)* Use simplex method to solve the LPP :

Maximize $Z = 5x_1 + 6x_2x_3$

subject to

$$9x_1 + 3x_2 - 2x_3 \le 5$$
$$4x_1 + 2x_2 - x_3 \le 2$$
$$x_1 - 4x_2 + x_3 \le 3$$
$$x_1, x_2, x_3 \ge 0$$ 6

*(b)* Explain the terms : 2+2=4

*(i)* Basic feasible solution

*(ii)* Optimal solution

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