**2023/TDC (CBCS)/EVEN/SEM/
COMHCC–402T/399**

TDC (CBCS) Even Semester Exam., 2023

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* of the following questions : 2×10=20

1. If $A = \begin{bmatrix} 2 & 3 \\ 0 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 0 \\ -2 & 0 \end{bmatrix}$, find AB.

2. If $f(x) = \dfrac{1}{1+x}$, then find $f\{f(x)\}$.

3. Evaluate $\lim\limits_{x \to -3} \dfrac{x^2 - 9}{x + 3}$.

J23/**693** (*Turn Over*)

(2)

4. Define increasing and decreasing functions.

5. Define homogeneous function of degree n.

6. Find the total differentiation of $u = 2x^2 - xy + 5y^2$.

7. Calculate CI on ₹ 15,000 at 5% p.a. for 3 years.

8. Define constraints.

9. Write two limitations of a linear programming problem.

10. Evaluate $\int_1^2 \log x\, dx$.

11. Define limit of a function.

12. Show that $f(x) = 3x^2 - x + 2$ is continuous at $x = 1$.

13. Define transposed matrix.

14. Prove that
$$\begin{vmatrix} 0 & c & b \\ -c & 0 & a \\ -b & -a & 0 \end{vmatrix} = 0$$

(Continued)

(3)

15. Find x and y if
$$\begin{bmatrix} 1 & x+y \\ x-y & 0 \end{bmatrix} = \begin{bmatrix} 1 & 7 \\ 1 & 0 \end{bmatrix}$$

SECTION—B

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

16. (a) Solve the following system of equations by matrix method :   5
$$2x + 4y + z = 5$$
$$x + y + z = 6$$
$$2x + 3y + z = 6$$

(b) If
$$A = \begin{bmatrix} 1 & 2 & 0 \\ 3 & -1 & 4 \end{bmatrix}$$
find AA^T and $A^T A$.   5

17. (a) If
$$\begin{bmatrix} 4 & 1 & 2 \\ 0 & 5 & 3 \end{bmatrix} \begin{bmatrix} 3 & 4 & 5 \\ -1 & 0 & -2 \\ 3 & 4 & 7 \end{bmatrix} = \begin{bmatrix} 8x+3y & 6z & 32 \\ 4 & 12 & 26x-5y \end{bmatrix}$$
find the values of x, y and z.   5

(b) Show that
$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$$
   5

(Turn Over)

(4)

18. *(a)* Evaluate :   2+3=5

     (i) $\displaystyle\lim_{x \to 0} \frac{1 - \sqrt{1 - x^2}}{x}$

     (ii) $\displaystyle\lim_{n \to \infty} \frac{1^2 + 2^2 + \cdots + n^2}{n^3}$

   (b)   *(i)* Examine the continuity of the given function at $x = 1$:

$$f(x) = 5x - 4 \quad ; \quad 0 < x \le 1$$
$$= 4x^2 - 3x; \quad 1 < x < 2$$

     (ii) Given $f(x) = ax^2 + bx + c$. Show that

$$\lim_{h \to 0} \left\{ \frac{f(x+h) - f(x)}{h} \right\} = 2ax + b$$
                                                 3+2=5

19. *(a)*   *(i)* Find the total revenue, average revenue and marginal revenue for the demand function

$$P = 13 - \frac{x}{200}$$

     (ii) Find $\dfrac{dy}{dx}$ if $y = \dfrac{\log x}{e^x}$.
                       2+3=5

   (b) Find the maximum and minimum values of $x^3 - 9x^2 + 24x - 12$.   5

(5)

20. *(a)*   *(i)* Find $\dfrac{\partial u}{\partial x}$ and $\dfrac{\partial u}{\partial y}$ for the following function :

$$u = 3x^3 - 5x^2 y + 2y^3$$

     (ii) Find the total differentiation of

$$u = 2x^2 - xy + 5y^2 \qquad \text{(2+2)+3=7}$$

   (b) Verify Euler's theorem for the function

$$f(x, y) = x^3 + 2x^2 y + y^3 \qquad 3$$

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

     (i) $\displaystyle\int x \log x \, dx$

     (ii) $\displaystyle\int \frac{x}{e^x} \, dx$

     (iii) $\displaystyle\int (3x + 2)^2 \, dx$

   (b) If the demand function is $P = 26 - 2x - x^2$ and the demand is 3, find the consumer's surplus.   4

22. *(a)* If the interest is compounded continuously, at what rate ₹ 5,500 would reach ₹ 10,000 in 9 years?   5

   (b) In how many years will an annuity of ₹ 400 amount to ₹ 4,064 at 3% p.a. CI?   5

(6)

23. (a) Find the present value of an annuity of ₹ 1,000 p.a. for 14 years allowing compound interest at 5%. 5

(b) If the cost of a machine is reduced from 10,000 to 1,250 in 3 years, find the rate of depreciation. 5

24. (a) Solve the following LPP using graphical method :

Maximize $Z = 3x_1 + 4x_2$

subject to

$$x_1 + x_2 \leq 450$$
$$2x_1 + x_2 \leq 600$$
$$x_1, x_2 \geq 0$$

6

(b) What are the major assumptions of a linear programming model? 4

25. (a) Use simple method to

Maximize $Z = 5x_1 + 6x_2 + x_3$

subject to

$$9x_1 + 3x_2 - 2x_3 \leq 5$$
$$4x_1 + 2x_2 - x_3 \leq 2$$
$$x_1 - 4x_2 + x_3 \leq 3$$
$$x_1, x_2, x_3 \geq 0$$

5

(7)

(b) (i) What are the steps to solve a linear programming problem?

(ii) What is simplex method in linear programming problem? 3+2=5

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