2023/TDC(CBCS)/ODD/SEM/
ECOHCC–102T/341

TDC (CBCS) Odd Semester Exam., 2023

ECONOMICS

(Honours)

(1st Semester)

Course No. : ECOHCC–102T

(Mathematical Methods in Economics–I)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks
for the questions

SECTION—A

Answer *ten* questions, selecting *two* from each Unit :   2×10=20

UNIT—I

1. What is binary number system?

2. Define Cartesian product.

3. Find the value of x for which the following function is not defined :

$$\frac{x^2 - 3x + 2}{x - 1}$$

(Turn Over)

(2)

UNIT—II

4. Define function.

5. Mention two differences between sequences and series.

6. What is convergent series?

UNIT—III

7. Find $\frac{dy}{dx}$, if $x = at^2$, $y = 2at$.

8. Define second-order derivative.

9. Find the marginal cost function for the average cost function

$$AC = 2 \cdot 5Q + 5 + \frac{48}{Q}$$

UNIT—IV

10. Find the slope of AVC when

$$TVC = 2x^3 - 500x^2 + 1000x$$

11. Determine whether $y = 1 + 2x - x^2$ rises, falls or remains stationary at $x = 1$.

12. Define convexity of a function.

(3)

UNIT—V

13. Define integration of a function.

14. Evaluate $\int (a^4 + x^4 + 2a^2 x^2) dx$.

15. Define linear difference equation.

SECTION—B

Answer *five* questions, selecting *one* from each Unit : 10×5=50

UNIT—I

16. (a) Evaluate :

$$\lim_{x \to \infty} \frac{7x^2 + x - 2}{3x^2 - 4x + 1}$$ 3

(b) Show that

$$\lim_{x \to 0} \frac{e^x - 1}{x} = 1$$ 3

(c) Define continuity of a function. Examine the continuity of the function

$$f(x) = 2x^2 - 1$$

at $x = 3$. 2+2=4

17. (a) There are 210 members in a club. 100 of them drink tea and 65 drink tea but not coffee. How many drink coffee? How many drink coffee but not tea? 2½+2½=5

(b) Let

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{2, 3, 5, 7\}$

$B = \{2, 7, 9, 10\}$

For the given sets, state and prove De Morgan's law. 5

UNIT—II

18. Write notes on the following : 10

(a) Polynomial function

(b) Rational function

(c) Exponential function

(d) Logarithmic function

(e) Algebraic function

19. *(a)* Test the convergence of the series

$$1 + \frac{1}{2} + \frac{2}{3} + \cdots + \frac{n}{n+1} + \cdots$$ 5

(b) Mention the conditions for continuity of a function. Check whether the function $f(x) = x^2$ is continuous at $x = 0$. 3+2=5

UNIT—III

20. *(a)* Find the derivative of

$(5 + 3x)^{10}(x^2 + 7)^8$ w.r.t. x 3

(b) If

$$y = \frac{\sqrt{x+a} + \sqrt{x-a}}{\sqrt{x+a} - \sqrt{x-a}}$$

find $\frac{dy}{dx}$. 3

(c) If $y = ae^{2x} + be^{-2x}$, prove that

$$\frac{d^2y}{dx^2} - 4y = 0$$ 4

21. *(a)* A company has the following total revenue and total cost structure :

$R = 3x$

$C = 100 + 0 \cdot 015x^2$

Find the production rate x that will maximise the profit of the firm. Also find the maximum profit. 5

(b) If the demand law is

$$p = (4 - 5x)^2$$

then at what value of x, the elasticity of demand is unity? 5

(6)

UNIT—IV

22. *(a)* Find local maximum and local minimum values of the following function :

$$f(x) = 3x^4 + 4x^3 - 12x^2 + 12 \qquad 5$$

(b) Show the points graphically [given in **22.***(a)*]. 2

(c) Check the convexity/concavity of the following function :

$$f(x) = \frac{x^2}{2} - 0 \cdot 9x + 2 \qquad 3$$

23. Discuss how the sign of first-order derivative $f'(x)$ determines the nature of the function or curve and the sign of second-order derivative $f''(x)$ relates the convexity and concavity of the function or curve. 10

UNIT—V

24. *(a)* Evaluate :

$$\int \frac{x}{2x^2 + 3} \, dx \qquad 3$$

(b) Evaluate :

$$\int x \sqrt[3]{x-2} \, dx \qquad 3$$

(c) Evaluate :

$$\int x^n \log x \, dx \qquad 4$$

(7)

25. *(a)* Distinguish between definite integral and indefinite integral. 3

(b) If the demand law is $p = 85 - 4x - x^2$, then what will be the consumer's surplus if $x_0 = 5$ and if $p_0 = 64$? 4

(c) Solve the equation

$$\Delta Y_t = -0 \cdot 2 Y_t \qquad 3$$

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