

**2023/TDC(CBCS)/ODD/SEM/
ECOHC-102T/341**

TDC (CBCS) Odd Semester Exam., 2023

ECONOMICS

(Honours)

(1st Semester)

Course No. : ECOHC-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 :

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

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

$$AC = 2.5Q + 5 + \frac{48}{Q}$$

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.

UNIT—V

13. Define integration of a function.
14. Evaluate $\int(a^4 + x^4 + 2a^2x^2)dx$.
15. Define linear difference equation.

SECTION—B

Answer *five* questions, selecting *one* from each

Unit : 10×5=50

UNIT—I

16. (a) Evaluate :

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

- (b) Show that

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

- (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? $2\frac{1}{2} + 2\frac{1}{2} = 5$

(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

$$1 + \frac{1}{2} + \frac{2}{3} + \dots + \frac{n}{n+1} + \dots$$

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 :

$$R = 3x$$

$$C = 100 + 0.015x^2$$

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

UNIT—IV

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

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

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

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

$$f(x) = \frac{x^2}{2} - 0.9x + 2 \quad 3$$

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 :

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

- (b) Evaluate :

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

- (c) Evaluate :

$$\int x^n \log x dx \quad 4$$

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
$$\Delta Y_t = -0.2Y_t$$
 3

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