

**2021/TDC/CBCS/ODD/  
ECOHCC-102T/452**

**TDC (CBCS) Odd Semester Exam., 2021  
held in March, 2022**

**ECONOMICS**

**( 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 any *ten* of the following questions :  $2 \times 10 = 20$

1. If  $A = \{0, 1\}$ ,  $B = \{2, 3\}$  and  $C = \{2, 3, 4\}$ , then find  $A \times (B \cap C)$ .
2. Construct a truth table for  $\sim p \wedge q$ .
3. Convert  $(101101)_2$  into decimal number.

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4. Give example of explicit and implicit functions one of each.

5. Formulate rule of the following sequence :

$$\{-6, -3, -2, 9, 18, \dots\}$$

6. Define convergent series with example.

7. Given,  $y = x^3 - 3x + 1$ , find

$$\frac{dy}{dx} \text{ and } \frac{d^2y}{dx^2}$$

8. The average cost function of a firm is as

$$AC = Q^2 - 3Q + 15 + \frac{27}{Q}$$

Find MC function of the firm.

9. Find the partial derivatives of  $z = x^3 e^{2y}$ .

10. How is saddle point differed from stationary point?

11. Define local and global optima.

12. Mention any two properties of convex function.

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13. Mention any two applications of integration in economic theory.
14. If  $MPS = 0.4$  and saving(s) = -50 when income ( $y$ ) = 0, then find saving function.
15. What do you mean by 'definite integral'?

SECTION—B

Answer any five of the following questions :  $10 \times 5 = 50$

16. (a) In a survey on reading newspaper in Silchar, the following results are obtained :
  - (i) 60% of the people read Dainik Jugasankha, 50% read Samayik Prasanga and 40% read Sentinal
  - (ii) 32% read Jugasankha and Sentinal
  - (iii) 20% read Samayik Prasanga and Sentinal
  - (iv) 30% read Samayik Prasanga and Jugansankha
  - (v) 8% do not read any of these newspapers.

Using operation of sets, find out percentage of people who read all these newspapers.

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- (b) Show that

$$(A - B) \cap B = \phi$$

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(c) If

$$f(x) = \begin{cases} \frac{x^2 - 1}{x - 1} & \text{for } x \neq 1 \\ 2 & \text{for } x = 1 \end{cases}$$

check the continuity of the function at  $x = 1$ .

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17. (a) Evaluate limit of the following :  $2+2=4$

(i)  $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$

(ii)  $\lim_{x \rightarrow \infty} \frac{3x^2 - x + 2}{x^2 + 8x - 1}$

(b) If  $A = \{1, 2, 3\}$  and  $B = \{-1, 0, 1\}$ ,  $x \in A, y \in B$ , then find  $xRy$  if  $y = 2x$ . Also find domain and range of the relation.

 $2+2=4$ 

(c) Convert  $2.\overline{28}$  into rational number. 2

18. (a) If

$$\frac{\log a}{a+b-2c} = \frac{\log b}{b+c-2a} = \frac{\log c}{c+a-2b}$$

then prove that  $abc = 1$ .

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(b) If

$$f(x) = b \frac{x-a}{b-a} + a \frac{x-b}{a-b}$$

then show that  $f(a) + f(b) = f(a+b)$ .

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(c) Draw the graph of the following functions : 2+2=4

(i)  $y = \log x$

(ii)  $y = \frac{c}{x}$  (c is constant)

19. (a) Show that

$$\{1^2 + 2^2 + 3^2 + \dots + n^2\} = \frac{n(n+1)(2n+1)}{6} \quad 3$$

(b) Test the convergence of the following series : 3<sup>1/2</sup>+3<sup>1/2</sup>=7

(i)  $\frac{1 \times 2}{3 \times 4 \times 5} + \frac{2 \times 3}{4 \times 5 \times 6} + \frac{3 \times 4}{5 \times 6 \times 7} + \dots \infty$

(ii)  $\sum \sqrt{\frac{n}{n^2 + 1}}$

20. (a) Following are the demand functions for the two commodities  $x_1$  and  $x_2$  :

$$x_1 = P_1^{-1.7} P_2^{0.8} \quad \text{and} \quad x_2 = P_1^{0.5} P_2^{-0.2}$$

(i) Determine whether the commodities are complementary or competitive.

(ii) Find four partial elasticities of demand. 2+4=6

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(b) Find  $dy/dx$  of the following : 2+2=4

(i)  $y = x^x$

(ii)  $y = \frac{(x-2)(2x+3)}{(x+7)(1-x)}$

• (a) Find the maximum and minimum of the following function : 4

$$y = 3x^4 - 10x^3 + 6x^2 + 5$$

(b) Given the demand function  $x = \sqrt{90 - P}$  and the cost function  $c = 10 + 2x^2 + 3x^3$ , determine the profit maximising output of a monopolist firm. What would be the impact of a tax of ₹ 10 per unit of output on price and profit? 3+3=6

2. (a) Find the global extrema of the function  $f(x) = x^3 - 3x^2 + 5$  on the interval  $[-1, 2.5]$ . 4

(b) For a convex function, prove that a local minimum is a global minimum. 6

3. (a) Check the convexity/concavity of the function

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

(b) Find possible inflection points for

$$f(x) = \frac{1}{9}x^3 - \frac{1}{6}x^2 - \frac{2}{3}x + 1$$
4

- (c) What conditions must be imposed on constants  $a$  and  $b$  in order that  $f(x) = x^3 + ax^2 + bx$  will have stationary points at  $x = 1$  and  $x = 3$ ? 3

4. (a) Find integral of the following : 3+3=6

(i)  $\int \frac{3x+4}{6x+7} dx$

(ii)  $\int \frac{1}{\sqrt{x+1} - \sqrt{x}} dx$

- (b) The price in the competitive market is determined by demand and supply laws. Find the producer's surplus when

$$P_d = 3x^2 - 20x + 5$$

$$P_s = 15 + 9x \text{ (} x \text{ is quantity)} \quad 4$$

25. (a) Solve  $y_{t+1} - 5y_t = 12$  with  $y_0 = 10$ . 4

- (b) Given the demand and supply functions for Cobweb model :

$$Q_{dt} = 10 - 2P_t$$

$$Q_{st} = -5 + 3P_{t-1}$$

Find intertemporal equilibrium price and also determine whether you will get stable equilibrium. 6

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