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)

$$\frac{\textit{Full Marks : 70}}{\textit{Pass Marks : 28}}$$

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 $A = \{0, 1\}$, $B = \{2, 3\}$ 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.

(*Turn Over*)

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

5. Formulate rule of the following sequence :

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

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.

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.   4

(b) Show that

$$(A - B) \cap B = \phi \qquad 2$$

(c) If

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

check the continuity of the function at $x = 1$.   4

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

   (i) $\displaystyle \operatorname*{Lt}_{x \to 0} \frac{e^x - 1}{x}$

   (ii) $\displaystyle \operatorname*{Lt}_{x \to \infty} \frac{3x^2 - x + 2}{x^2 + 8x - 1}$

   (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 $2 \cdot \overline{28}$ 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 $abc = 1$.   3

   (b) If

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

then show that $f(a) + f(b) = f(a + b)$.   3

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

  (i) $y = \log x$

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

19. (a) Show that

$$\{1^2 + 2^2 + 3^2 + \cdots + n^2\} = \frac{n(n+1)(2n+1)}{6} \qquad 3$$

  (b) Test the convergence of the following series : $\qquad$ 3½+3½=7

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

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

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

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

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

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

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

   (i) $y = x^x$

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

. (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 $[-1, 2 \cdot 5]$.   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

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

     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

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

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

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

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

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

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

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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