

**2020/TDC (CBCS)/ODD/SEM/
ECOHCC-102T/452**

**TDC (CBCS) Odd Semester Exam., 2020
held in March, 2021**

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

1. Answer any ten of the following questions :

2×10=20

- (a) Define continuity of a function.
- (b) Mention the truth table for $p \wedge q$.
- (c) Express $0.111 \dots$ in the form of fraction.
- (d) If $A = \{-1, 1\}$, then find $A \times A$.

(e) Define polynomial function with example.

(f) Write the first four terms of the sequence

$$a_n = n \frac{n^2 + 5}{4}$$

(g) What is the difference between a series and a sequence?

(h) Draw the graph of the function $y = 2x^2$ for the range $-2 < x < 2$.

(i) Find the first four derivatives for the function $y = 9x^3 - 9$.

(j) Obtain the differential dy when

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

(k) Given the total cost function

$$C = 15q - 6q^2 + q^3$$

derive the equation of MC curves.

(l) Write single-variable optimization conditions for $y = f(x)$.

(m) Why are convex functions important?

(n) Mention any two properties of a convex function.

(o) What is the local optimal solution?

(p) Find the value of x at which the function $f(x) = (x - 4)^2$ reaches an extremum. Describe the nature of this extremum.

(q) Define indefinite integrals.

(r) Mention any two rules of operation for definite integral.

(s) Evaluate :

$$\int ae^{4x} dx$$

(t) Given the marginal propensity to consume

$$C'(y) = 0.7 + 0.1y^2$$

find the consumption function $C(y)$.

SECTION—B

Answer any five questions

2. (a) If $A = \{7, 8, 9\}$, $B = \{0, 1, 8, 9\}$ and $C = \{4, 3, 7, 9\}$, then find—

(i) $A \times (B \cap C)$;

(ii) $(A \times B) \cap (A \times C)$;

(iii) $A \times (B \cup C)$;

(iv) $(A \times B) \cup (A \times C)$;

(v) $(A \cup B) - C$;

(vi) $(A \cup B) - C'$.

(4)

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(b) A market research group conducted a survey of 1000 consumers and reported that 720 consumers like product A and 450 consumers like product B. What is the least number that must have liked both products? 4

3. (a) Evaluate: 3+3=6

(i) $\lim_{x \rightarrow 0} \frac{\sqrt{4+x}-2}{x}$

(ii) $\lim_{x \rightarrow \infty} \frac{5+6x}{x^2}$

(b) Prove that the following function is continuous at $x=4$: 4

$f(x) = 6 + 5x + 4x^2 + 3x^3$

4. (a) Solve : 6

$\log(x) + \log(x+3) = \log(20-5x)$

(b) Show that $f(x) = 3x+2$ and $g(x) = \frac{x-2}{3}$ are inverses of each other. 4

5. (a) Find the sum of the sequence 5

7, 77, 777, 7777, ... to n terms

(b) Does the series $\sum_{n=1}^{\infty} \frac{n^3}{n^5+3}$ converge? 5

Explain.

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(Continued)

(5)

6. (a) Find $\frac{dy}{dx}$, when—

(i) $y = e^x x^n$;

(ii) $y = \log(ax^2 + bx + c)$. 3+3=6

(b) The demand function is given by

$q = 7 - 2p$

Calculate e_d , when $p=1$ and $p=2$. 4

7. (a) Obtain the extrema for the function

$C = q^3 + 2q^2 - 4q + 4$ 5

(b) The total cost (C) and total revenue (R) functions of a firm are given by

$C = 5q^2 + 10$ and $R = -2q^2 + 6q$

Find the output level (q) at which profit of the firm is maximum. 5

8. (a) Discuss the geometric properties of a linear function. 4

(b) Given the price equation, $P = 100 - 2Q$, where Q is quantity demanded. Find—

(i) the marginal revenue (MR);

(ii) the price elasticity of demand, when $Q = 10$;

(iii) the nature of the commodity. 6

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(Turn Over)

9. (a) Explain local and global maxima with suitable graphical representation. 5
- (b) Prove that a cubic function must have a point of inflexion. 5

10. Find the integral of the following : 3+3+4=10

(i) $\int (x+a)^3 dx$

(ii) $\int \frac{(a^x + b^x)^2}{a^x \cdot b^x} dx$

(iii) $\int_0^1 x(1-x)^n dx$

11. (a) The supply function of a firm is given by

$$p = q^2 + 2q + 1$$

Given that the equilibrium is reached at $q = 3$. Find producer surplus at the equilibrium quantity. 4

- (b) Obtain the solution of the equation

$$y_{t+1} - 2y_t = 4$$

Given that $y_t = 4$, when $t = 0$. 6

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