



# 2022/TDC/ODD/SEM/ECOHCC-102T/452

**TDC (CBCS) Odd Semester Exam., 2022**

**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*

## UNIT—I

1. Answer any *two* of the following : 2×2=4

(a) Draw appropriate Venn diagrams for  $(A \cup B)'$ .

(b) Enumerate all the subsets of the set  $S = \{a, b, c, d\}$ .



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(c) Evaluate

$$\lim_{x \rightarrow \infty} \frac{4x^2 - 9x}{5x^2 - 34}$$

2. Answer either (a) or (b) : 10

(a) (i) What is logical statement? What are the characteristics of a statement?

2+3=5

(ii) Define the implication of statements. Write the truth table for the implication of two given statements  $p$  and  $q$ .

2+3=5

(b) Discuss the importance of proof techniques in economic analysis. Explain the different types of proof that are used in mathematical analysis.

4+6=10

UNIT—II

3. Answer any two of the following : 2×2=4

(a) What type of functional form is shown by the equation of an indifference curve?

(b) Evaluate  $f(x) = 2x^2 + 5x + 9$  at  $x = a$ ;  $x = (a - 3)$ .

(c) Define arithmetic progression of a sequence.

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4. Answer either (a) or (b) : 10

(a) (i) Draw the relation graphically as given by the set  $\{(x, y) | y \leq x\}$ . In the theory of firm economists, consider the relationship as  $Q : C = f(Q)$ . According to the definition of a function, should each cost (C) figure be associated with a unique level of output? 3+2=5

(ii) If  $f(x) = \frac{ax+b}{bx+a}$ , prove that  $f(x) \cdot f\left(\frac{1}{x}\right) = 1$ . 5

(b) (i) For what value of  $K$ , the following series will be in arithmetic progression?

$3k^2 + k + 1, 2k^2 + k, 4k^2 - 6k + 1$  5

(ii) Given  $y = f(x) = \frac{x^2 + x - 20}{x - 4}$ . Is this function continuous at  $x = 4$ ? Why? 5

UNIT—III

5. Answer any two of the following : 2×2=4

(a) Define degree of the differential function.

(b) Give the geometrical meaning of derivative.



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- (c) Find the second-order differential coefficient w.r.t.  $x$  when  $y = 6x^3 - 8x^2 + 12x - 6$ .

6. Answer either (a) or (b) :

- (a) (i) For what value of  $x$ , the following expression is maximum or minimum?

$$y = 4x^3 - 15x^2 + 12x - 2$$

Also find the maximum and minimum values.

- (ii) The demand function  $Q_1 = 80 - 4P_1$  intersects another demand function  $Q_2$  at  $P = 5$ . If the elasticity of demand for  $Q_2$  is one fourth as large as that of  $Q_1$  at that point, then find  $Q_2$ , assuming it is also linear.

- (b) (i) A producer has the possibility of discriminating between domestic and foreign markets for a product where the demands respectively are  $Q_1 = 21 - 0.1P_1$  and  $Q_2 = 50 - 0.4P_2$ . Also  $TC = 2000 + 10Q$ . What price will the producer charge to maximize profits with discrimination between markets?

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- (ii) A firm has the following AR and TC functions :

$$AR = 160 - Q$$

$$TC = 200 + 4Q + 7Q^2$$

A subsidy of ₹ 4 per unit of output is paid. Find (1) profit maximizing output, (2) maximum profit and (3) effect of subsidy on equilibrium price.

#### UNIT—IV

7. Answer any two of the following : (2×2=4)

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

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

- (b) Find the slope of AC when  $AC = Q^2 - 3Q + 15 + \frac{27}{Q}$ .

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



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8. Answer either (a) or (b) : 10

(a) (i) Explain local and global maxima with suitable graphs. 5

(ii) Following are the demand functions for two commodities  $x$  and  $y$ . Determine whether the commodities are competitive or complementary : 5

$$x = P_x^{-1.7} P_y^{0.8} \text{ and } y = P_x^{0.5} P_y^{-0.2}$$

(b) (i) Explain the extrema of the function  $y = 2x^3 - 3x^2 + 3x + 7$ . 5

(ii) A TV manufacturer produces  $x$  sets per week at a total cost of ₹  $(x^2 + 7 \cdot 8x + 2500)$ . He is a monopolist and the demand function for his product is  $x = \frac{9600 - P}{8}$ , when the price is ₹  $P$  per set. Show that the maximum net revenue (i.e., profit) is obtained when 529 sets are produced per week. What is the monopoly price? 5

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UNIT—V

9. Answer any two of the following : 2×2=4

(a)  $\int \sqrt{x^5} dx$

(b)  $\int \frac{dx}{x+a}$

(c)  $\int \left( 2\sqrt{x} - \frac{8}{\sqrt{x}} \right) dx$

10. Answer either (a) or (b) : 10

(a) (i) Show that

$$\int_0^4 6x dx = \int_0^3 6x dx + \int_3^4 6x dx \quad 2$$

(ii) Integrate  $\int_0^2 \frac{3x^2}{(x^3 + 1)^2} dx$ . 3

(iii) Given the demand function  $P_d = 25 - Q^2$  and the supply function  $P_s = 2Q + 1$ . Assuming pure competition, find consumers' surplus and producers' surplus. 5



(b) (i) Given  $MC = 25 + 30Q - 9Q^2$ , fixed cost is 55. Find TC and AC. 3

(ii) The MPS is given as  $0.5 - 0.2Y^{-1/2}$ . There is dissaving of 3.5 when income is 25. Find the saving function. 3

(iii) Solve the following difference equation and check the answer using  $t=0$  and  $t=1$  :

$$x_t + 3x_{t-1} + 8 = 0 \text{ and } x_0 = 16 \quad 4$$

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