

2023

(FYUGP)

(1st Semester)

ECONOMICS

(Major)

Paper Code : EC1 CC2

(Mathematical Methods for Economics—1)

Full Marks : 75

Pass Marks : 40%

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer five questions, taking one from each Unit

UNIT—I

1. (a) Distinguish between equal and equivalent sets. Give examples. 4
- (b) If  $A = \{a, b, c, d, e\}$ ,  $B = \{a, c, e, g\}$  and  $C = \{b, e, f, g\}$ , then show that
- $$A \cap (B \cap C) = (A \cap B) \cap C$$
- 5

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(Turn Over)

(2)

- (c) If  $E = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ ,  $A = \{1, 2, 3, 4\}$  and  $B = \{2, 4, 5, 7\}$ , then find  $(A \cap B)'$  and  $A' \cup B'$ . Also show that
- $$(A \cap B)' = A' \cup B'$$
- 6

2. (a) Define functions with example. 3

(b) Solve the following system of equations :

$$(i) \quad 2x + 3y = 5$$

$$3\frac{1}{2}x - 2y = 7$$

$$(ii) \quad 2x^2 - 5x + 3 = 0$$

(c) Draw the graph of the function

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

UNIT—II

3. (a) Define 'real number'. State and explain with example the 'axioms of the field' of real number. 2+9=11

(b) What do you mean by 'axioms of trichotomy' and 'axioms of transitivity' of real number? 4

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(Continued)

4. (a) Define 'complex number'. Rationalize the following complex numbers :  $2+4+4=10$

(i)  $\frac{1+2i}{2+i}$

(ii)  $\frac{3-4i}{3+4i}$

(b) Find the square root of the following complex numbers :  $2\frac{1}{2} \times 2 = 5$

(i)  $-8-6i$

(ii)  $-5-12i$

UNNT—III

5. (a) Find the slope and intercept of the line

$3x - 2y + 7 = 0$

$3+2=5$

(b) Find the equation of the line passing through the point  $(-2, 4)$  having slope equal to  $-\frac{4}{5}$ .

5

(c) The vertices of a triangle ABC are  $A(a, 0)$ ,  $B(-a, 0)$  and  $C(0, a\sqrt{3})$ . Show that the triangle is an equilateral one.

5

6. (a) Find the centre and radius of the following circle :

$3x^2 + 3y^2 - 6x + 12y - 5 = 0$

7

(b) Find the equation of circle if centre is  $(-3, -1)$  and radius is  $-6$ . 3

(c) Define parabola. The parabola  $y^2 = Px$  passes through the point  $(2, -4)$ . Find its 'atus rectum' and 'focus'. 2+3=5

UNNT—IV

7. (a) What is function? Briefly explain the role of functions in Economics. 2+3=5

(b) Find the limit of the following functions :  $2+4+4=10$

(i)  $\lim_{x \rightarrow 2} (10 - 6x + x^2)$

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

(iii)  $\lim_{x \rightarrow 5} \frac{x^2 - 25}{x^2 + x - 30}$

8. (a) Find  $\frac{dy}{dx}$ , if—

(i)  $y = \frac{x^2}{1+x}$

(ii)  $y = (x^2 + 1)^3 (x^3 - 1)^2$  4+5=9

( 5 )

(b) In a perfectly competitive market, the price of a product Q is ₹ 4 per unit and total cost (C) of a firm is given by

$$C = Q^3 - 15Q^2 + 31Q + 100$$

Find profit maximizing output and maximum profit. 6

UNNT—V

9. (a) Find the following integrals : 2+4+4=10

(i)  $\int (2x^2 + 3x - 10) dx$

(ii)  $\int (8x + 2)(2x^2 + x)^5 dx$

(iii)  $\int \frac{8x}{(2x^2 + 1)} dx$

(b) The marginal revenue function is given by  $MR = 50 - 4Q$ . Find the point elasticity of demand when  $Q = 10$ . 5

10. (a) If consumer's demand function is given by

$$Q = f(P) = \sqrt{60 - \frac{3}{2} \cdot P}$$

then find consumer's surplus when market price  $P = 16$ . 7½

( 6 )

(b) If the producer's supply function is given by

$$Q = -5 + \frac{4}{5} \cdot P$$

and market price  $P = 15$ , then find the producer's surplus. 7½

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