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

(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 : $3\frac{1}{2} \times 2 = 7$

(i) $2x + 3y = 5$
$5x - 4y - 1 = 0$

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

(c) Draw the graph of the function

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

UNIT– II

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

(b) What do you mean by 'axioms of trichotomy' and 'axioms of transitivity' of real number? 3

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 : 2½×2=5

(i) $-8-6i$

(ii) $-5-12i$

UNIT—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 : 7

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

(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 'latus rectum' and 'focus'. 2+3=5

UNIT—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) $\lim_{x \to 2} (10 - 6x + x^2)$

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

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

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

(Continued)

(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

UNIT—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

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

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

(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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