2020

ECONOMICS — HONOURS

Paper : CC-2

(Mathematical Methods-I)

Full Marks : 65

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Group - A

1. Answer ***any ten*** questions :   2×10

   (a) Given $y = 3x^2 + 2$, if the range of the function is

   $$R = \{y | 14 \le y \le 29\},$$

   find the domain of the function.

   (b) What do you mean by a polynomial function?

   (c) Express the colours of rainbow in set notation.

   (d) Let $y = x^2 - 2x - 1$, $x > 0$, denote a total function. Sketch the graph.

   (e) Use Cramer's rule to solve the system of equations :

   $$2x_1 + 3x_2 = 5$$
   $$7x_1 - 5x_2 = 2$$

   (f) Find the inverse of the given matrix :

   $$A = \begin{bmatrix} 2 & 3 \\ 7 & -5 \end{bmatrix}$$

   (g) Let $A = \begin{bmatrix} 2 & 4 \\ -1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 8 \\ 0 & 1 \end{bmatrix}$ be two matrices. Show that $(A + B)' = A' + B'$.

   (h) Define a two person zero sum game with a hypothetical example.

   (i) Find 'b' such that $f(x)$ is continuous,

   $$f(x) = \begin{cases} 2x^2 + b, & x \ge -1 \\ -x^3, & x < -1 \end{cases}$$

   (j) A firm's demand function is given by : $p = 100 - 2q$. Can you obtain the relationship between the slopes of corresponding Average Revenue and Marginal Revenue Curves?

Please Turn Over

(k) The Total Cost (TC) and Total Revenue (TR) functions of a firm are respectively given by :

$$TC = 4q^2 + 10, \ TR = -2q^2 + 6q.$$

Find the profit maximizing output level (q).

(l) Find the value of the following two person zero sum game with the help of maximin-minimax principle :

Strategies ↘		Player II			
		D	E	F	G
Player I	A	3	−1	4	2
	B	−1	−3	−7	0
	C	4	−6	2	−9

(m) If $x = 2t + 3$, $y = t^2 - 1$, obtain $\dfrac{dy}{dx}$.

(n) What is Hawkins-Simon Condition?

(o) Comment on the curvature of the given function :

$$y = 7 + 2p - p^2$$

Group - B

Answer *any three* questions. 5×3

2. The demand curve faced by a firm is given by : $p = 20 - 3q$. If the firm's average cost (AC) is given by : $AC = 10q - 5$, find the optimal output level of the firm assuming that the objective of the firm is to maximise its profit.

3. What will be the present value of a perpetual cash flow of ₹ 250 per year, discounted at the rate of 10% each year?

4. Find the rank of the given matrix.

$$A = \begin{bmatrix} 2 & -1 & 3 \\ 1 & 0 & 1 \\ 0 & 2 & -1 \\ 1 & 1 & 4 \end{bmatrix}$$

5. Of the 200 candidates who were interviewed for a position at a call centre, 100 had a two-wheeler, 70 had a credit card and 40 had a mobile phone. 40 of them had both a two-wheeler and a credit card; 30 had both a credit card and a mobile phone; and 60 had both a two-wheeler and a mobile phone. 10 had all three. How many candidates had none of the three?

6. A demand function is given by $p = a.x^b$ ($a > 0$, $b > 0$). Obtain the marginal revenue function. Comment on the likely shape of the marginal revenue function.

Group - C

Answer *any three* questions.

7. (a) Examine whether the function :

$$y \begin{cases} = 9 - x, & \forall\, 0 < x \le 6 \\ = x - 3, & \forall\, x \ge 6 \end{cases}$$

is differentiable at $x = 6$.

(b) Does the function show monotonicity?

$$f(x) = ax^2 + bx + c \quad (a, b, c > 0)$$ 5+5

8. (a) Using L'Hospital's rule find :

$$\lim_{x \to 0} \frac{e^x - 1}{x}$$

(b) If the Marginal Cost (MC) function of a firm is

$$M = \frac{a}{\sqrt{ax + b}};$$

and if the cost of zero output is zero, find the Total Cost (TC) function.   5+5

9. Consider the following Leontief System where the input matrix and final demand vector are given by :

$$A = \begin{bmatrix} 0.05 & 0.25 & 0.34 \\ 0.33 & 0.1 & 0.12 \\ 0.19 & 0.38 & 0 \end{bmatrix}, \quad d = \begin{bmatrix} 1800 \\ 200 \\ 900 \end{bmatrix}$$

(a) Check whether the system satisfies the Hawkins-Simon conditions.

(b) Find the value of the three outputs.   5+5

10. In a market, demand and supply curves are given respectively as :

$$p = (2.44)^2 q^{(-2)}; \text{ and } q = 1 \cdot 5$$

Find the elasticity of demand at the equilibrium price.   10

11. Consider the following game :

Strategies↘		Player II		
		D	E	F
Player I	A	7, 6	5, 8	0, 0
	B	5, 8	7, 6	1, 1
	C	0, 0	1, 1	4, 4

Is there any dominant strategy for each player? Is there any pure strategy Nash equilibrium?   5+5

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