

**2 0 1 8**

( Pre-CBCS )

( 5th Semester )

**ECONOMICS**

SEVENTH PAPER

**( Quantitative Techniques—I )**

*Full Marks : 75*

*Time : 3 hours*

**( PART : A—OBJECTIVE )**

( *Marks : 25* )

*The figures in the margin indicate full marks for the questions*

SECTION—A

( *Marks : 10* )

Tick (✓) the correct answer in the brackets provided :

1×10=10

**1.** How many subsets are there altogether in the set  $S = \{1, 2, 3, 4\}$ ?

(a) 4 ( )

(b) 8 ( )

(c) 12 ( )

(d) 16 ( )

2. Which of the following pairs of sets are disjoint?

(a)  $\{a, e, i, o, u\}$  and  $\{c, d, e, f\}$  ( )

(b)  $\{x, y, z\}$  and  $\{a, z\}$  ( )

(c)  $\{2, 4, 8, 10, 12\}$  and  $\{3, 6, 9\}$  ( )

(d)  $\{0, 4, 8, 16\}$  and  $\{1, 2, 4, 8\}$  ( )

3. The derivative of  $x^{n-1}$  is

(a)  $nx^{n-1}$  ( )

(b)  $(n-1)x^{n-1}$  ( )

(c)  $(n-1)x^{n-2}$  ( )

(d)  $nx^{n-2}$  ( )

4. A monopolist's demand curve is given by  $p = 100 - 2q$ . Identify the slope of AR.

(a)  $50 - q$  ( )

(b)  $50$  ( )

(c)  $-2q$  ( )

(d)  $-2$  ( )

5. What is the value of  $\int 1 dx$ ?

(a)  $\frac{1}{2}x^2 + c$  ( )

(b)  $x + c$  ( )

(c)  $\frac{1}{2}x^2$  ( )

(d)  $0$  ( )

6. Integration of any given marginal revenue functions will yield

- (a) total revenue function ( )
- (b) average revenue function ( )
- (c) demand function ( )
- (d) supply function ( )

7. Identify the singular matrix.

- (a)  $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$  ( )
- (b)  $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$  ( )
- (c)  $\begin{pmatrix} 1 & 0 \\ 2 & 4 \end{pmatrix}$  ( )
- (d)  $\begin{pmatrix} 2 & 4 \\ 3 & 6 \end{pmatrix}$  ( )

8. The value of  $A \begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix}$ , is

- (a) -2 ( )
- (b) 3 ( )
- (c) 5 ( )
- (d) 7 ( )

9. The feasible region of a linear programming problem is

- (a) a concave set ( )
- (b) a convex set ( )
- (c) a null set ( )
- (d) a singleton set ( )

10. Regarding non-negativity constraints, the constraints remain unchanged in

- (a) primal ( )
- (b) dual ( )
- (c) both primal and dual ( )
- (d) None of the above ( )

SECTION—B

( Marks : 15 )

Answer the following questions :

3×5=15

1. Define finite and infinite sets.
2. What is meant by elasticity of demand?
3. If  $MC = 5X^2$ , then find the total cost function.
4. Define rank of a matrix.
5. Write a note on the concept of dual.

( PART : B—DESCRIPTIVE )

( Marks : 50 )

The figures in the margin indicate full marks for the questions

1. (a) Define dependent and independent variables. 4
- (b) Verify the associative law of union and intersection by using the following sets : 4
- $$A = \{4, 5\}, B = \{3, 6, 7\} \text{ and } C = \{2, 3\}$$
- (c) Let the demand function of a commodity is  $D = 24 - 2P$  and its supply function is  $S = 5 + 7P$ . Find the equilibrium price. 2

OR

2. (a) Distinguish between logarithmic and exponential functions. 4
- (b) Given  $A = \{4, 5, 6\}$ ,  $B = \{3, 4, 6, 7\}$  and  $C = \{2, 3, 6\}$ , verify the distributive law of union and intersection. 4
- (c) Enumerate all the subsets of the set  $\{a, b, c\}$ . 2
3. (a) Evaluate the limits of the following : 2+2=4
- (i)  $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$
- (ii)  $\lim_{x \rightarrow 5} \frac{4x^2 - 5x - 6}{3x^2 - 4x - 5}$
- (b) Find the relative extrema of the function  $y = x^3 - 3x^2 - 2$ . 3
- (c) Given the supply function  $S = 100 + 2P$ , find the elasticity of supply with respect to price at  $P = 10$ . 3

**OR**

4. (a) Find the derivatives of the following : 2+2=4

(i)  $y = (x^2 - 2x - 5)^{10}$

(ii)  $y = \log \frac{x-1}{x+1}$

(b) The total cost function of a firm is given by  $TC = 200Q - 5Q^2 + 0.05Q^3$ , where  $Q$  is the quantity produced. Find (i) the marginal cost function and (ii) the output level at which marginal cost (MC) is equal to average cost (AC). 2+4=6

5. (a) Evaluate the following : 2×3=6

(i)  $\int (x^3 - x - 1) dx$

(ii)  $\int (5e^x - x^2 + \frac{3}{x}) dx$

(iii)  $\int_1^5 3x^2 dx$

(b) If the demand curve is  $p = 85 - 4x - x^2$ , where  $p$  and  $x$  are respectively the price and the amount demanded of a commodity, what will be the consumers surplus when  $p = 64$ ? 4

**OR**

6. (a) If  $MR = 16 - x^2$ , find the total revenue function and the average revenue function. Calculate the total revenue when  $x = 10$ . 6

(b) If the demand and supply functions for a commodity are  $P_d = 3x^2 - 20x + 5$  and  $P_s = 15 - 9x$  respectively, find the producer's surplus at equilibrium price. 4

7. (a) State and prove the basic properties of determinants. 6

(b) Given that

$$A = \begin{pmatrix} 5 & 2 \\ 6 & 1 \end{pmatrix}, B = \begin{pmatrix} 1 & 3 \\ 5 & 4 \end{pmatrix}$$

Find  $A - 2B + I$ , where  $I$  is an identity matrix of  $2 \times 2$ . 4

**OR**

8. (a) What is column matrix? 2

(b) Solve the following equations by using matrix inversion method or Cramer's rule : 8

$$\begin{aligned} x + y + z &= 4 \\ x + y + 3z &= 8 \\ x + 2y + z &= 0 \end{aligned}$$

9. Use graphical method to solve the linear programming problem. Also indicate the feasible region.

Minimize  $C = 3x_1 + 2x_2$   
subject to

$$\begin{aligned} 5x_1 + x_2 &= 10 \\ x_1 + x_2 &= 6 \\ x_1 + 4x_2 &= 12 \end{aligned}$$

and  $x_1, x_2 \geq 0$  8+2=10

**OR**

10. Explain the meaning of linear programming. What are the main assumptions of the technique of linear programming? 2+8=10

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