2022

(CBCS)

(5th Semester)

ECONOMICS

SEVENTH PAPER

(Quantitative Techniques—I)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

Simple calculator can be used in this paper

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. A set which contains no elements is

(a) null set or empty set ( )

(b) universal set ( )

(c) equivalent set ( )

(d) finite set ( )

2. If A and B are sets and $A \quad B \quad A \quad B$, then

(a) A ( )

(b) B ( )

(c) $A \quad B$ ( )

(d) None of the above ( )

3. Differential calculus can be used to solve problems in cases where economic relationships are expressed in the form of

(a) a graph ( )

(b) an equation ( )

(c) a table ( )

(d) None of the above ( )

4. Given the function $y \quad 5x^4 \quad 2x^3 \quad 10x^2 \quad 2x \quad 6$, the third-order derivative is

(a) $20x^3 \quad 6x^2 \quad 20x \quad 2$ ( )

(b) $120x \quad 12$ ( )

(c) 120 ( )

(d) 0 ( )

5. Producer's surplus can be obtained by integrating

(a) supply function ( )

(b) demand function ( )

(c) revenue function ( )

(d) cost function ( )

6. An integral that possesses no definite numerical views is termed as

(a) an indefinite integral ( )

(b) a definite integral ( )

(c) partial integral ( )

(d) None of the above ( )

7. If $A \begin{matrix} 1 & 2 \\ 2 & 4 \end{matrix}$, what is trace of A (tr A)?

(a) 3 ( )

(b) 4 ( )

(c) 5 ( )

(d) 6 ( )

8. Identify the singular matrix.

(a) $\begin{matrix} 0 & 1 \\ 1 & 0 \end{matrix}$ ( )

(b) $\begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$ ( )

(c) $\begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix}$ ( )

(d) $\begin{matrix} 1 & 2 \\ 2 & 4 \end{matrix}$ ( )

9. The linear function of the variables which is to be maximized or minimized is called

(a) constraint ( )

(b) objective function ( )

(c) decision variable ( )

(d) non-negativity constraint ( )

10. 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 ( )

(SECTION : B—SHORT ANSWER)

(*Marks* : 15)

Answer the following : 3×5=15

UNIT—I

1. Distinguish between equal sets and equivalent sets.

OR

2. What are single and multivalued functions?

UNIT—II

3. Write the inter-relationship among total, marginal and average revenues.

OR

4. What are the first-order and second-order conditions for optimization?

UNIT—III

5. Define consumer's surplus.

OR

6. What is meant by definite integral?

UNIT—IV

7. Differentiate between determinant and matrix.

OR

8. What is rank of a matrix?

UNIT—V

9. Explain feasible and basic solutions.

OR

10. Formulate the dual problem of the following LPP :

$$\text{Max } Z \quad 7x_1 \quad 9x_2$$

subject to

$$x_1 \quad 2x_2 \quad 15$$
$$x_1 \quad 3x_2 \quad 12$$
$$x_1, x_2 \quad 0$$

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer the following : 10×5=50

UNIT—I

1. *(a)* Define dependent and independent variables. 3

(b) Distinguish between finite and infinite sets with example. 3

(c) State and prove the distributive laws of union and intersection by using the following sets : 4

$A \quad \{2, 3\} \quad B \quad \{1, 3, 4\} \quad C \quad \{3, 5, 7\}$

OR

2. *(a)* Find the Cartesian products AB and BA from the following : 3

$A \quad \{0, 1\}, \quad B \quad \{ \ 3, \quad 2\}$

(b) In a class of 50 students, 30 students take Mathematics, 25 students take Economics and 10 take both. Find the number of students taking neither of the two subjects. 3

(c) If the demand and supply functions for a commodity are given by $Q_d \quad 10P \quad 6$ and $Q_s \quad 4P \quad 12$ respectively, find *(i)* the equilibrium price and quantity and *(ii)* the market demand and supply at the price of ₹ 25. 2+2=4

UNIT—II

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

(i) $y \quad 3x^4 \quad e^{7x} \quad 9\log x \quad 3$

(ii) $y \quad \dfrac{(x^3 \quad 3x^2)}{x^2 \quad 2}$

(b) Find the partial derivatives of the function $z \quad 3x^2 \quad xy \quad 4y^2$. 2

(c) Given $y \quad x^2 \quad 2x \quad 1$, determine whether the function is maximum or minimum. 4

OR

4. *(a)* Given AR 60 3Q, find the total revenue function and the marginal revenue function. 2

(b) The total cost function is given by C Q^3 $12Q^2$ $60Q$.

(i) Find at what level of output AC is minimum.

(ii) Verify that at a minimum of AC, AC = MC. 3+2=5

(c) Given the demand function Q 150 15P, where P is the price. Find the elasticity of demand at P 4. 3

UNIT—III

5. *(a)* Find the producer's surplus for the supply function P 10 2x, when the equilibrium price for the product is ₹ 20. 4

(b) Evaluate the following (any *two*) : 3×2=6

(i) $\int_2^5 2x\,dx$

(ii) $(5 \quad 2x)\,dx$

(iii) $(3 \quad 2x)(2x \quad 3)\,dx$

OR

6. *(a)* If the marginal cost function of a firm is 100 10x 0 1x^2, where x is the output, obtain the total cost function of the firm under the assumption that its fixed cost is ₹ 500. 4

(b) Given the demand function p 35 2x x^2, the demand x_0 is 3, what will be the consumer's surplus? 4

(c) If MR = 100 Q, then find the total revenue function. 2

UNIT—IV

7. *(a)* What is idempotent matrix? 2

(b) Given $A = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix}$; $B = \begin{matrix} 1 & 2 \\ 2 & 1 \end{matrix}$, find *(i)* $2A \quad 3B$ and *(ii)* AB. 2+2=4

(c) Obtain the inverse of matrix $A = \begin{matrix} 3 & 4 \\ 1 & 2 \end{matrix}$. 4

OR

8. *(a)* Write the basic properties of determinants. 4

(b) Solve the following equation system : 6

$$\begin{aligned} 3x \quad 2y \quad 3z \quad 8 \\ 2x \quad y \quad z \quad 1 \\ 4x \quad 3y \quad 2z \quad 4 \end{aligned}$$

UNIT—V

9. Use graphical method to solve the linear programming problem. Also indicate the feasible region : 8+2=10

Maximize $Z \quad 6x_1 \quad 21x_2$

subject to

$$\begin{aligned} x_1 \quad 2x_2 \quad 3 \\ x_1 \quad 4x_2 \quad 4 \\ 3x_1 \quad x_2 \quad 3 \\ x_1 \quad 0, \; x_2 \quad 0 \end{aligned}$$

OR

10. What is meant by dual? What are the main assumptions of the technique of linear programming? 2+8=10

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