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(CBCS)

(5th Semester)

ECONOMICS

SEVENTH PAPER

(Quantitative Techniques—I)

Full Marks : 75

Time : 3 hours

Simple calculator can be used in this paper

(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. A cubic function may be used to describe

(a) marginal revenue in a perfect competition ( )

(b) a trade cycle ( )

(c) average fixed cost ( )

(d) None of the above ( )

2. A set which contains all the elements in question is

(a) null set or empty set ( )

(b) finite set ( )

(c) universal set ( )

(d) equivalent set ( )

3. The sufficient condition (second-order condition) for maximum value is

(a) $\frac{d^2y}{dx^2}$ 0 ( )

(b) $\frac{d^2y}{dx^2}$ 0 ( )

(c) $\frac{d^2y}{dx^2}$ 0 ( )

(d) $\frac{d^2y}{dx^2}$ 0 ( )

4. If the minimum of AC is equal to 120, then MC will be

(a) 60 ( )

(b) 150 ( )

(c) 120 ( )

(d) 0 ( )

5. The integration of the exponential function (e^x) is

(a) $\log x \quad c$ ( )

(b) $e^x \quad c$ ( )

(c) $1 \quad e$ ( )

(d) e^x ( )

6. Integration of any given marginal cost function will yield

(a) total cost function ( )

(b) average cost function ( )

(c) demand function ( )

(d) slope of the average cost ( )

7. The necessary condition for a square matrix A to possess an inverse is

(a) $|A|$ 0 ( )

(b) $|A|$ 0 ( )

(c) $|A|$ 0 ( )

(d) $|A|$ 0 ( )

8. The determinant of a matrix equals

(a) the determinant of its transpose ( )

(b) the transpose of its determinant ( )

(c) the inverse of its determinant ( )

(d) the transpose of the inverse ( )

9. Which of the following is not an assumption of linear programming problems?

(a) Linearity ( )

(b) Negativity ( )

(c) Well-objective function ( )

(d) Divisibility ( )

10. The optimal solution of all linear programmes are found at

(a) outside the feasible region ( )

(b) the middle of the feasible region ( )

(c) the lowest point of the feasible region ( )

(d) the extreme points ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. *(a)* Name any three uses of quadratic functions in economics.

OR

(b) Distinguish between null and universal sets.

2. *(a)* Explain the differentiability of a function.

OR

(b) Mention the relationship between marginal revenue and average revenue.

3. *(a)* Distinguish between integrand and integral.

OR

(b) If $P \quad 10$, $Q \quad 5$ and $f(Q)\,dQ \quad 42$, then how much is the producer's surplus?

4. *(a)* What is the transpose of a matrix?

OR

(b) What is an identity matrix?

5. *(a)* Explain the meaning of linear programming.

OR

(b) Formulate dual of the given linear programming problem :

Maximize $Z \quad 8x \quad 6y$

subject to constraints

$$6x \quad 3y \quad 126$$
$$2x \quad 4y \quad 96$$
$$x, y \quad 0$$

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Distinguish between equal set and equivalent set. 4

(b) Verify the distributive law of union and intersection by using the following sets : 4

$$A \quad \{4, 5, 6\}, \; B \quad \{3, 4, 6, 7\} \text{ and } C \quad \{2, 3, 6\}$$

(c) In a class of 50 students, 25 students take Economics, 20 students take Mathematics and 5 take both. Find the number of students taking neither of the two subjects. 2

OR

2. *(a)* What is the difference between dependent and independent variables? 4

(b) Given $S_1 \quad \{3, 6, 9\}$, $S_2 \quad \{9, 4\}$ and $S_3 \quad \{m, n\}$. Find the Cartesian product $S_1 \quad S_2 \quad S_3$. 3

(c) If the supply and demand functions for a commodity are $Q_d \quad 51 \quad 3P$ and $Q_s \quad 6P \quad 10$ respectively, then find the equilibrium price. 3

3. *(a)* Find $\frac{dy}{dx}$ from the following functions (any *three*) : 2×3=6

(i) $y \quad (2x^2 \quad 3)(4x \quad 1)$

(ii) $y \quad (2x^2 \quad 3x)^5$

(iii) $y \quad \frac{x^2 \quad 1}{2 \quad x}$

(iv) $y \quad 2at$ and $x \quad t^2 \quad 1$

(b) Find the partial derivatives of the following (any *two*) : 2×2=4

(i) $z \quad (6x \quad 7y)/(5x \quad 3y)$

(ii) $z \quad (3x \quad 5)(2x \quad 6y)$

(iii) $z \quad 2x^2 \quad 3xy \quad 40y^2 \quad 100$

OR

4. *(a)* Given the revenue function of a firm $R \quad 4000Q \quad 33Q^2$ and the total cost function $C \quad 2Q^3 \quad 3Q^2 \quad 400Q \quad 500$. Find the profit maximizing level of output. 3

(b) A firm's revenue function is given as $TR \quad 12Q \quad Q^2$. Find the marginal revenue and average revenue function. 3

(c) Describe the necessary and sufficient conditions for maximization and minimization. 4

5. *(a)* Evaluate the following (any *three*) : 2×3=6

(i) $2x(x^2 \quad 1)\,dx$

(ii) $8e^{2x \quad 3}dx$

(iii) ${}_{1}^{3}(4x \quad x^2 \quad 3)\,dx$

(iv) $x\log x$

(b) The marginal cost function for some product is $(1 \quad 2x \quad 6x^2)$, where x is the output. Find the total cost function when $x \quad 2$. 4

OR

6. *(a)* If the demand function is $p \quad 35 \quad 2x \quad x^2$ and the demand x_0 is 3, then what will be the consumer's surplus? 4

(b) The supply and demand function are given as $P_s \quad 15 \quad 9x$ and $P_d \quad 3x^2 \quad 20x \quad 5$ respectively. Find the producer's surplus. 6

7. *(a)* Given $A \quad \begin{matrix} 1 & 2 & 0 \\ 2 & 1 & 2 \end{matrix}$ and $B \quad \begin{matrix} 2 & 1 \\ 1 & 1 \\ 0 & 2 \end{matrix}$. Find the product of the two matrices. 3

(b) Solve the following equations by matrix inversion method : 7

$$\begin{matrix} 2x & 4y & 3z & 2 \\ 3x & 2y & z & 5 \\ x & 3y & z & 12 \end{matrix}$$

OR

8. *(a)* If $A \quad \begin{matrix} 3 & 1 \\ 4 & 2 \end{matrix}$, then prove that $A \; ^1A \quad 1$. 4

(b) Solve the following simultaneous equations by Cramer's rule : 6

$$\begin{matrix} x & y & z & 1 \\ 2x & 4y & z & 6 \\ x & 2y & 2z & 2 \end{matrix}$$

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

Minimize $\quad C \quad 3x_1 \quad 2x_2$

subject to

$$\begin{matrix} 5x_1 & x_2 & 10 \\ x_1 & x_2 & 6 \\ x_1 & 4x_2 & 12 \end{matrix}$$

and $\quad x_2, x_2 \quad 0$

OR

10. What is meant by dual? Discuss various procedures involved in the formulation of linear programming problem. 2+8=10

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