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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. One variable expressed directly in terms of the other variables is a/an

(a) explicit function ( )

(b) implicit function ( )

(c) rational function ( )

2. If there is a one-to-one correspondence between the elements of the two sets, then the sets are said to be

(a) equal sets ( )

(b) equivalent sets ( )

(c) disjoint sets ( )

3. If $\frac{dy}{dx}$ 0, then

(a) the curve rises from left to right ( )

(b) the curve remains stationary ( )

(c) the curve falls from left to right ( )

4. Total revenue (TR) is maximum, when

(a) MR 0 ( )

(b) MR 0 ( )

(c) MR 0 ( )

5. If MC $4q^3$ $6q^2$ $4q$, then TC is

(a) q^4 $3q^3$ 4 ( )

(b) q^4 $2q^3$ $2q^2$ ( )

(c) $6q^2$ $12q$ 4 ( )

6. dx

(a) 1 ( )

(b) x^2 ( )

(c) x c ( )

7. If any two rows/columns of a determinant are interchanged, then

(a) the value of the determinant remains unchanged ( )

(b) the value of the determinant is zero ( )

(c) the sign of the determinant changes ( )

8. A special type of matrix in which there is only one row or one column is a/an

(a) vector ( )

(b) indentity matrix ( )

(c) singular matrix ( )

9. In a linear programming problem, if the given constraints fail to define a feasible region, then

(a) multiple optimal solution will exist ( )

(b) there will be no feasible solution ( )

(c) None of the above ( )

10. The set of constraints in LP problem defines

(a) a feasible region ( )

(b) an optimal solution ( )

(c) the objective function ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. *(a)* Distinguish between linear and quadratic equations.

OR

(b) Define cartesian product.

2. *(a)* If $y \quad x^3 \quad 5x^2$, find f , when $x \quad 2$.

OR

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

3. *(a)* Define consumer's surplus.

OR

(b) If MR 50 $7q$, then calculate the total revenue function.

4. *(a)* Define rank of a matrix.

OR

(b) Explain singular matrix.

5. *(a)* What is linear programming?

OR

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

Maximize $Z \quad 2x_1 \quad 3x_2$

subject to

$$2x_1 \quad x_2 \quad 20$$
$$x_1 \quad 2x_2 \quad 20$$

and $x_1, \; x_2 \quad 0$

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Define exogenous and endogenous variables. 3

(b) Enumerate all the proper subsets of set $A \quad \{a, b, c\}$. 3

(c) State and verify associative laws of union and intersection by using the following sets :

$A \quad \{1, 2, 4\}, \quad B \quad \{4, 5, 6\}$ and $C \quad \{3, 4, 6, 7\}$ 4

OR

2. *(a)* Distinguish between finite and infinite sets. 3

(b) If $E \quad \{a, b, c, d, e\}$ and $A \quad \{b, c, e\}$, then find the complement of A. 2

(c) In a survey of 100 students, it was found that 50 passed in Economics, 40 in Mizo, 55 in Geography, 15 in Economics and Mizo, 20 in Economics and Geography, 16 in Mizo and Geography and 3 in none of these subjects. How many students passed in all the three subjects? 5

3. *(a)* State the condition for optimization of a function. 2

(b) Find the point elasticity of demand for the demand function $q \quad 7 \quad 2p$, when $p \quad 2$. 4

(c) Find the derivatives for the following functions (any *two*) : 2×2=4

(i) $y \quad \frac{x \quad 5}{x \quad 3}$

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

(iii) $y \quad (7x^2 \quad 3x)(4x \quad 2)$

OR

4. (a) Find the partial derivatives of $Z \quad (x \quad 4)(2x \quad 5y)$. 2

(b) The total revenue and total cost functions of a firm are given by $R \quad 30q \quad q^2$ and $C \quad 20 \quad 4q$ respectively. Find the profit maximizing output level. 3

(c) If $C \quad 2Q^3 \quad Q^2 \quad 4Q$, where Q is the output—

(i) find MC;

(ii) verify that at a minimum of average cost, AC MC. 1+4=5

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

(i) $(5x \quad 3)^3 \, dx$

(ii) $xe^x dx$

(iii) $\int_0^2 (3x^2 \quad 2x \quad 3) \, dx$

(b) If MR $\quad 16 \quad q^2$, then find the total and average revenue functions. 2+2=4

OR

6. (a) The demand and supply functions are given by $P_d \quad 3q^2 \quad 20q \quad 5$ and $P_s \quad 15 \quad 9q$ respectively, determine the producer's surplus under pure competition. 6

(b) The marginal cost function of a firm is given by MC $\quad 5 \quad 2x$, where x is the output. Find the total cost function, if the fixed cost is ₹ 200. 4

7. *(a)* Find the inverse of the matrix $A \begin{matrix} 3 & 1 \\ 4 & 2 \end{matrix}$. 4

(b) If $A \begin{matrix} 3 & 1 \\ 1 & 2 \end{matrix}$ and $B \begin{matrix} 2 & 4 \\ 3 & 0 \end{matrix}$, verify whether (AB) $A\,B$, where A and B are transposes of the matrices A and B respectively. 6

OR

8. *(a)* Given that

$$A \begin{matrix} 7 & 1 \\ 0 & 4 \end{matrix} \quad B \begin{matrix} a & b \\ c & d \end{matrix} \quad \text{and} \quad C \begin{matrix} 2 & 1 \\ 1 & 3 \end{matrix}$$

Find the values of a, b, c and d, if A B C. 3

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

$$\begin{matrix} x & 2y & 3z & 1 \\ 3x & y & 4z & 3 \\ 2x & y & 2z & 1 \end{matrix}$$ 7

9. Discuss the various basic assumptions for the application of linear programming problems. 10

OR

10. Solve the following linear programming problem by graphical method and indicate the feasible region in the diagram : 8+2=10

Maximize $Z \quad 3x_1 \quad 4x_2$

subject to

$$\begin{matrix} x_1 & x_2 & 6 \\ 2x_1 & 4x_2 & 21 \\ x_1, & x_2 & 0 \end{matrix}$$

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