# 2013

( 5th Semester )

## ECONOMICS

SEVENTH PAPER

**( Quantitative Techniques )**

*Full Marks* : 75

*Time* : 3 hours

( PART : B—DESCRIPTIVE )

( *Marks* : 50 )

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



Answer **all** questions

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

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

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

   (c) In a class, 65 percent of the students have taken economics and 55 percent have taken history. How many students have taken both the subjects? 3

*Or*

(a) Given $S_1 = \{a, b, c\}$, $S_2 = \{1, 2\}$, find the Cartesian products : 3

(i) $S_1 \times S_2$, (ii) $S_2 \times S_1$

(b) If the supply and demand functions for a commodity are $Q_s = 5P + 25$, $Q_d = 10P - 5$ respectively, find the equilibrium price. 4

(c) If the universal set

$\Omega = \{0, 1, 2, 3, 4, 5, 6\}$

$A = \{1, 2, 4, 5\}$

$B = \{4, 5, 6\}$

prove that $(A \cup B)' = A' \cap B'$, where $A'$ and $B'$ are complements of set $A$ and set $B$ with reference to the universal set. 3



**2.** When the total cost function is represented by $TC = 2q^3 - 2q^2 + 4q$, where $q$ stands for output of the commodity—

(a) calculate the level of output at which the average cost is minimum;

(b) find AC and MC functions. 5+5=10

*Or*

(a) Differentiate any *two* of the following functions with respect to $x$ : 5

(i) $y = \dfrac{x^2 + 3x - 1}{x + 2}$

(ii) $y = e^x (x^3 + \sqrt{x})$

(iii) $y = 4x^2 + 3\log x - e^{2x}$

(b) Evaluate : 5

$$\lim_{x \to 3} \left( \frac{x^2 + x - 2}{x^2 + 6x - 7} \right)$$

3. (a) Evaluate the following : 3+3=6

(i) $\int_0^2 (x^3 - 4x^2 + x)\, dx$

(ii) $\int_1^3 \dfrac{3 + x^2}{x^2}\, dx$

(b) The demand function of certain product is given by $P = 25 - 2x$. Calculate the Consumer's surplus when the equilibrium price for the product is Rs 5. 4

*Or*

(a) Find the producer's surplus for the supply function $P = 10 + 2x$, when the equilibrium price for the product is Rs 20. 5

*(b)* The marginal revenue function of a product is given by $R = 5 + 3x - x^2$. Find the total revenue. 5

Given $R = 112$, when $x = 6$

**4.** *(a)* Given that

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix}$$

Find $2A + B$. 5

*(b)* Solve the following equations by using Cramer's rule : 5

$$x + 6y - z = 10$$
$$2x + 3y + 3z = 17$$
$$3x - 3y - 2z = -9$$

*Or*

*(a)* If

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

prove that $(AB)' = B'A'$, where $A'$ and $B'$ are transposes of the matrices $A$ and $B$ respectively. 5

*(b)* Find the inverse of the matrix

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

and verify that $AA^{-1} = I$, where $I$ is an identity matrix of the order 2×2. 5

**5.** Using graphical method, maximize

$$\pi = 40x_1 + 30x_2$$

subject to

$$x_1 \leq 16$$

$$x_2 \leq 8$$

$$x_1 + x_2 \leq 24$$

and $x_1, x_2 \geq 0$ 10

*Or*

A farmer is advised to utilise at least 900 kg of mineral $A$ and 1200 kg of mineral $B$ to increase the productivity of crops in his field. Two fertilisers, $F_1$ and $F_2$ are available at a cost of Rs 60 and Rs 80 per bag. If one bag of $F_1$ contains 20 kg of mineral $A$ and 40 kg of mineral $B$ and one bag of $F_2$ contains 30 kg of each mineral $A$ and $B$, formulate a suitable linear programming problem and obtain the optimal solution.

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**2013**

( 5th Semester )

**ECONOMICS**

SEVENTH PAPER

**( Quantitative Techniques )**

( PART : A—OBJECTIVE )

( *Marks* : 25 )



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

Answer **all** questions

SECTION—A

( *Marks* : 10 )

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

**1.** Which of the following is the form of a linear equation?

(a) $y = a + bx$ ( )

(b) $y = a + bx + \log x$ ( )

(c) $y = a + bx^2$ ( )

2. Marginal revenue function can be obtained by differentiating

(a) average revenue function ( )

(b) total revenue function ( )

(c) marginal cost function ( )

3. Equations which are satisfied by the same value of the unknown quantities are

(a) simultaneous equations ( )

(b) quadratic equations ( )

(c) linear equations ( )

4. When average cost (AC) rises, then

(a) MC = AC ( )

(b) MC < AC ( )

(c) MC > AC ( )

5. Consumer's surplus can be obtained by integrating

(a) supply curve ( )

(b) demand curve ( )

(c) None of the above ( )

6. In a square matrix, the number of columns is —— the number of rows.

(a) less than ( )

(b) more than ( )

(c) equal to ( )



7. Rank of a matrix is equal to

(a) the number of independent columns/ rows ( )

(b) its determinant ( )

(c) the number of rows less than the number of columns ( )

**8.** If any two rows (or columns) of a matrix are equal, the value of the determinant is

(a) zero ( )

(b) one ( )

(c) infinity ( )

**9.** Interchanging the rows and columns of a matrix $A$ is called

(a) inverse of a matrix ( )

(b) transpose of a matrix $A$ ( )

(c) rank of a matrix $A$ ( )

**10.** The task of solving a linear programming is to find out the

(a) minimum profit ( )

(b) optimal feasible solution ( )

(c) constraints ( )

## SECTION—B

( *Marks* : 15 )

Answer **all** questions : 3×5=15

**1.** Define linear and quadratic equations.

**2.** Define continuity of a function.

3. Define the rank of a matrix.

4. What are the first-order and second-order conditions for the maxima and minima of a function?

**5.** If

$$A = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

obtain $AB$.

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