2017

(5th Semester)

ECONOMICS

SEVENTH PAPER

(Quantitative Technique—I)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* State and prove the distributive laws of union and intersection by using the following sets : 4

$A = (0, 1)$, $B = (1, a, e)$ and $C = (1, e, f)$

(b) Sets A and B are such that set A has 20 scheduled tribe students while B has 30 female students, and $A \cup B$ has 45 students. Find the number of $A \cap B$. 3

(c) Distinguish between quadratic function and linear function. 3

OR

2. *(a)* Elaborate the applications of linear and non-linear equations in economics. 5

(b) Define subset and proper subset. 3

(c) If $\xi = \{1, 2, 3, 5\}$ and $A = \{1, 2, 5\}$, find A'. 2

3. *(a)* Find the point of discontinuity of function

$$f(x) = \frac{x^2 - 4x}{x^2 - 4x + 4}$$ 2

(b) The function is defined as follows :

$$f(x) = x + 2, \quad \text{when} \quad x > 2$$
$$= x - 4, \quad \text{when} \quad x < 2$$
$$= 2, \quad \text{when} \quad x = 2$$

Is $f(x)$ continuous at $x = 2$? 2

(c) Find $\frac{dy}{dx}$ for the following equations (any *three*) : 2×3=6

(i) $y = (2x^2 + 3)(4x + 1)$

(ii) $y = (2x^2 + 3x)^5$

(iii) $y = e^x x^2$

(iv) $y = \frac{x + 4}{x - 1}$

OR

4. *(a)* The demand function is given by $q = 25 - 4p + p^2$. Find the elasticity of demand, when $p = 4$. 4

(b) The total cost function is given by $C = q^3 - 2q^2 + 2q$.

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

(ii) Verify that at a minimum of average cost, $AC = MC$. 3+3=6

5. *(a)* The price of the quantity demanded under pure competition is determined by the demand and supply functions $P_d = \frac{8}{x+1} - 2$ and $P_s = \frac{1}{2}(x+3)$ respectively. Find the consumer's surplus. 6

(b) The marginal cost (MC) function for a firm is

$$MC = -2q + 150$$

Find—

(i) the total cost function;

(ii) the average cost function. 2+2=4

OR

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

(i) $\int_1^2 (x^3 - 2x + 5)\,dx$

(ii) $\int x \log x\,dx$

(iii) $\int \left(\frac{5}{x} + 5e^{2x} + 3\right) dx$

(b) Find the producer's surplus when the demand and supply functions are $P_d = 8 - 3x$ and $P_s = 4x - 6$ respectively. 4

7. *(a)* Explain the properties of a determinant by giving suitable examples. 6

(b) Verify whether $AB = BA$ using the following matrices : 4

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

OR

8. *(a)* Using Cramer's rule or matrix inversion method, determine the values of x, y and z from the following system of equations : 7

$$x - 2y + z = 8$$
$$2x + y + 3z = 12$$
$$x + y + z = 6$$

(b) Define rank of matrix. 3

9. Using graphical method

Maximize $Z = 2x_1 + 5x_2$

subject to

$$x_1 + 4x_2 \leq 24$$
$$3x_1 + x_2 \leq 21$$
$$x_1 + x_2 \leq 9$$
$$\text{and } x_1 \geq 0, x_2 \geq 0$$

Indicate the feasible region. 8+2=10

OR

10. (a) Discuss the relevance of linear programming in profit maximization of a firm. 4

(b) What are the processes involved in the formulation of linear programming? 6

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SEVENTH PAPER

(Quantitative Technique—I)

(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. Which one of the following is in the form of a linear function?

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

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

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

(d) $xy = xy^2 + x^2y$ ( )

2. Any set containing n number of elements has _____ number of subsets.

(a) $2n^2$ ( )

(b) 2^n ( )

(c) n^2 ( )

(d) $2n^2 - 1$ ( )

3. The value for a function $y = f(x)$ is minimum, if

(a) $\frac{dy}{dx} = 0$ and $\frac{d^2y}{dx^2} > 0$ ( )

(b) $\frac{dy}{dx} = 0$ and $\frac{d^2y}{dx^2} < 0$ ( )

(c) $\frac{dy}{dx} = 1$ and $\frac{d^2y}{dx^2} > 0$ ( )

(d) $\frac{dy}{dx} = 1$ and $\frac{d^2y}{dx^2} < 0$ ( )

4. The profit of a firm is maximum at

(a) $MC < AC$ ( )

(b) $MC = MR$ ( )

(c) $MC > AC$ ( )

(d) $AC = MC$ ( )

5. If $MC = 3Q^2 - 2Q + 15$, then TC is

(a) $6Q - 2$ ( )

(b) $6Q^3 - 2Q^2 + 15Q$ ( )

(c) $Q^3 - Q^2 + 15Q$ ( )

(d) $Q^3 - Q^2 - 15Q$ ( )

6. $\int e^x dx =$

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

(b) $\frac{1}{x} + c$ ( )

(c) $e^x + c$ ( )

(d) None of the above ( )

7. A square matrix A is singular, if

(a) $|A| \neq 0$ ( )

(b) $|A| > 0$ ( )

(c) $|A| < 0$ ( )

(d) $|A| = 1$ ( )

8. When the rows and columns of a matrix are interchanged, it is termed as

(a) identity matrix ( )

(b) transpose of a matrix ( )

(c) diagonal matrix ( )

(d) square matrix ( )

9. The optimal solution of linear programming is found

(a) at the corner point of feasible region ( )

(b) outside the feasible region ( )

(c) at the origin of the graph ( )

(d) None of the above ( )

10. In linear programming problem, linearity of the constraints implies that

(a) each resource is heterogeneous ( )

(b) each resource is not heterogeneous ( )

(c) each resource is homogeneous ( )

(d) each resource is not homogeneous ( )

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

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

3. Integrate the following function :

$$y = x^{-2} + e^x + \frac{1}{x}$$

4. Given that

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, \quad C = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$$

What are the values of a, b, c and d, if $A + B = C$?

5. Formulate the dual of the given primal :

Maximize $\Pi = 9x_1 + x_2$

subject to

$$2x_1 + x_2 \leq 8$$
$$4x_1 + 3x_2 \leq 14$$
$$\text{and } x_1, x_2 \geq 0$$

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