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2 SEM TDC ECOH (CBCS) C 4

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(May/June)

ECONOMICS

(Core)

Paper : C-4

(Mathematical Methods in Economics—II)

Full Marks : 80

Pass Marks : 32

Time : 3 hours

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

1. Choose the correct answer/Answer the following : 1×8=8

(a) The time path of price is convergent when

- (i) slope of supply curve is steeper than the demand curve
- (ii) slope of demand curve is greater than the slope of supply curve
- (iii) slope of demand curve is equal to slope of supply curve
- (iv) None of the above

(b) Select the correct statement.

- (i) The value of a determinant changes if the rows and columns are interchanged.
- (ii) If two rows of a determinant are identical, the value of the determinant will be non-zero.
- (iii) If any two rows are interchanged, the sign of the determinant will alter, but numerical value will remain same.
- (iv) All of the above

(c) If $|A| \neq 0$, then A is

- (i) zero matrix
- (ii) singular matrix
- (iii) non-singular matrix
- (iv) diagonal matrix

(d) If the total cost function is

$$C = 2Q^3 - 15Q^2 + 30Q + 16$$

then the AVC will be

- (i) $6Q^2 - 30Q + 30$
- (ii) $2Q^2 - 15Q + 30 + \frac{16}{Q}$
- (iii) $2Q^2 - 15Q + 30$
- (iv) 16

(e) The profit maximization in multi-product firm, producing two products, requires that

- (i) $|H_1| > 0$ and $|H_2| < 0$
- (ii) $|H_1| > 0$ and $|H_2| > 0$
- (iii) $|H_1| < 0$ and $|H_2| = 0$
- (iv) $|H_1| < 0$ and $|H_2| > 0$

(f) Define homogeneous production function.

(g) The cross elasticity of demand in case of complementary goods is

- (i) positive
- (ii) negative
- (iii) independent
- (iv) zero

(h) The least cost combination of inputs requires

- (i) slope of indifference curve = slope of budget line
- (ii) slope of isoquant = slope of isocost curve
- (iii) the isoquant is convex to the origin
- (iv) Both (ii) and (iii)

(4)

2. Answer any four of the following : 4×4=16

- (a) Write a note on economic application of first-order difference equation.
- (b) Explain briefly the inverse of a matrix and its properties.
- (c) Prove that for any scalar λ ,

$$\lambda(A + B) = \lambda A + \lambda B$$

- (d) What is meant by Constant Elasticity of Substitution (CES) production function? Prove that CES production function is a linear homogeneous function.
- (e) The marginal revenue and marginal cost functions of a firm are given as

$$MR = 25 - \frac{1}{2}Q$$

$$MC = 0.2Q^2 - \frac{1}{3}Q + 2$$

and total fixed cost is 10. Find out total profit when the firm produces and sells 10 units of output.

- 3. (a) (i) Solve the difference equation $Y_{t+1} - Y_t = 10$ and $Y_0 = 5$. 4
- (ii) In a Cobweb model

$$Q_{dt} = a - bP_t \quad (a, b > 0)$$

$$Q_{st} = -c + dP_{t-1} \quad (c, d > 0)$$

$$Q_{dt} = Q_{st}$$

Obtain the time path P_t and analyze the condition for its convergence. 7

(5)

Or

- (b) (i) Given, slope of demand curve $|\alpha| = 3$ and slope of supply curve $|\beta| = 4$. Determine whether equilibrium is stable. 1
- (ii) Given the demand and supply function as

$$3X_{dt} = 20 - P_t$$

$$3X_{st} = -20 + 7P_{t-1}$$

Find the equilibrium price, the time path and determine, whether or not the equilibrium is stable. 7

- (iii) Solve the following difference equation by iterative method : 3

$$Y_{t+1} - Y_t = 5 \quad \text{and} \quad Y_0 = 10$$

- 4. (a) (i) Define rank of a matrix. 1
- (ii) Evaluate the following determinant : 3

$$\begin{vmatrix} 1 & 1 & 3 \\ 2 & -2 & 1 \\ 1 & 0 & -2 \end{vmatrix}$$

- (iii) Solve the following national income model using Cramer's rule : 6

$$Y = C + I_0 + G_0$$

$$C = \alpha + \beta(Y - T) \quad (\alpha > 0, 0 < \beta < 1)$$

$$T = \gamma + \delta Y \quad (\gamma > 0; 0 < \delta < 1)$$

(6)

Or

- (b) (i) Find the inverse of the following matrix A : 4

$$A = \begin{bmatrix} 2 & 0 & -5 \\ 4 & 1 & 2 \\ -3 & 0 & 1 \end{bmatrix}$$

- (ii) Solve the following system of simultaneous equations by matrix inversion : 6

$$4x_1 + 2x_2 - x_3 = 40$$

$$2x_1 + 3x_2 = 43$$

$$x_1 + 3x_3 = 38$$

5. (a) (i) Distinguish between Cobb-Douglas production function and CES production function. State and prove the properties of Cobb-Douglas production function. 2+10=12

- (ii) Mention two important reasons as to why CES production function is superior to Cobb-Douglas production function. 2

Or

- (b) (i) Given $z = \frac{(3x-y)}{(x^3+3y)}$. Find $\frac{\delta z}{\delta x}$ and $\frac{\delta z}{\delta y}$. 4

(7)

- (ii) If the total cost of a function is given by $TC = 100 - 2q + 0.5q^2$, show that the slope of average cost curve is negative when output is less than 10. 6

- (iii) A consumer has a utility function $u = u(Q) = \alpha Q^\beta$, $\alpha > 0$; $0 < \beta < 1$. Does the utility function display diminishing marginal utility? 4

6. (a) A monopolist produces two products Q_1 and Q_2 jointly. His cost function is

$$TC = Q_1^2 + \frac{1}{4}Q_2^2 + 20Q_1Q_2 + 10$$

$$AR_1 = 32 - 3Q_1$$

$$AR_2 = 16 - 4Q_2$$

- Find profit maximizing output and maximum profit. 7+3=10

Or

- (b) A monopolist has the following total revenue (R) and total cost (C) functions :

$$R = 30q - q^2$$

$$C = q^3 - 15q^2 + 10q + 100$$

- Find (i) profit maximizing output, (ii) maximum profit and (iii) point elasticity of demand at equilibrium level of output. 4+3+3=10

7. (a) (i) Using Lagrange multiplication method, find the extreme value of the function

$$Y = x_1^2 + x_1x_2 + \frac{3}{2}x_2^2$$

subject to $x_1 + 2x_2 = 14$.

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- (ii) A consumer has a utility function $u = xy$, where x and y are the goods purchased and his budget constraint is given by $B = xP_x + yP_y$. Find out demand functions for x and y .

6

Or

- (b) Cost and production function of a firm that wants to produce 64 units at minimum cost are respectively $C = 2L + 4K$ and $Q = 8L^{1/4}K^{1/2}$. Find the quantity of K and L .

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