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# 2 SEM TDC ECOH (CBCS) C 4

## 2025

( May )

## 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.** Answer the following as directed : 1×8=8

*(a)* The time path of price is convergent if

*(i)* slope of supply curve > slope of demand curve

*(ii)* slope of supply curve = slope of demand curve

*(iii)* slope of supply curve < slope of demand curve

*(iv)* None of the above

( Choose the correct option )

(b) Define rank of a matrix.

(c) $(AB)^{-1} = ?$

(i) $B^{-1}A$ (ii) $A^{-1}B$

(iii) $A^{-1}$ (iv) $B^{-1}A^{-1}$

( Choose the correct option )

(d) The elasticity of substitution in CD production function is _____.

( Fill in the blank )

(e) Given a demand function of Engel's curve type $D = AP^{\alpha}N^{\beta}$, the $\frac{\delta D}{\delta P} = ?$

(i) $\beta \cdot AP^{\beta-1}N^{\beta}$

(ii) $\alpha \cdot AP^{\alpha-1}N^{\beta}$

(iii) $\beta \cdot AP^{\alpha}N^{\beta-1}$

(iv) None of the above

( Choose the correct option )

(f) The return to scale in linearly homogeneous production function is

(i) constant

(ii) increasing

(iii) decreasing

(iv) negative

( Choose the correct option )



( Continued )



(g) The necessary conditions for equilibrium of discriminating monopolist is

(i) $MR = MC$

(ii) $MR_1 = MR_2 = MC$

(iii) $MR = MC_1 = MC_2$

(iv) None of the above

( Choose the correct option )

(h) Given $u = 5\log x_1 + 2\log x_2$ subject to the budget constraint $4x_1 + 2x_2 = 28$, write the Lagrange function.

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

(a) Write a note on economic application of difference equation.

(b) What is determinant? Differentiate between determinant and matrix.

(c) Explain briefly the homogeneous production function. State the homogeneity of CD production function.

(d) Given $TC = 2Q^2 + 5Q + 18$, find the slope of average cost curve.

(e) If $A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \end{bmatrix}$, show that $IA = AI = A$.



( Turn Over )

3. *(a)* *(i)* Solve the difference equation $y_{t+1} + 3y_t = 10$ with $y_0 = 20$. 4

*(ii)* Given the demand and supply functions as $Q_{dt} = 10 - 2P_t$ and $Q_{st} = -5 + 3P_{t-1}$. Find intertemporal equilibrium price and also determine whether the equilibrium is stable or not. 7

*Or*

*(b)* In a Cobweb market model

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

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

$Q_{dt} = Q_{st}$

Obtain the time path of $P_t$ and analyze the conditions of equilibrium. 11

4. *(a)* *(i)* Find the inverse of the following matrix : 4

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

*(ii)* Define with example transpose of a matrix and identity matrix. 4+4=8



( Continued )



*Or*

*(b)* *(i)* Explain the properties of indifference curves. 6

*(ii)* Solve the following market model using Cramer's rule : 6

$Q_d = 10 - 0 \cdot 4P$

$Q_s = -3 + 0 \cdot 6P$

$Q_d = Q_s$

5. *(a)* *(i)* Given $y = \dfrac{(2x_1 - x_2^2)}{(x_1^2 + 3x_2)}$, find $\dfrac{\delta y}{\delta x_1}$ and $\dfrac{\delta y}{\delta x_2}$. 4

*(ii)* Given the production function of Cobb-Douglas type

$$Q = f(K, L) = 200K^{1/2} L^{4/5}$$

(1) Find the slope of isoquant, $\dfrac{dK}{dL}$.

(2) Show that the isoquant is convex to the origin. 3+4=7

*Or*

*(b)* State and prove the properties of Cobb-Douglas production function. 11



( Turn Over )

6. *(a)* The total cost function of a firm is given by

$$C = Q^3 - 6Q^2 + 2Q + 50$$

*(i)* Find the level of output at which average variable cost is minimum.

*(ii)* Show that AVC = MC at that level of output. 6+5=11

*Or*

*(b)* A monopolist discriminates between two markets and the price equations are given by

$$P_1 = 60 - 4Q_1$$
$$P_2 = 42 - 3Q_2$$

where $Q_1$ and $Q_2$ are the outputs of first and second markets. The total cost function is given by $C = 50 + 12Q$ where $Q = Q_1 + Q_2$. Find—

*(i)* profit maximizing output and prices;

*(ii)* elasticity of demand of the markets;

*(iii)* maximum profit. 5+4+2=11

7. *(a)* *(i)* Minimize $y = x_1^2 - x_1x_2 + 2x_2$ subject to $2x_1 + 4x_2 = 12$. 6



( Continued )



*(ii)* Given the utility function $u = xy$ and budget constraint $\beta = xP_x + yP_y$, find out the demand functions for $x$ and $y$. 5

*Or*

*(b)* A producer desires to minimize the cost of production $C = 16K + 4L$, where $K$ and $L$ are capital and labour respectively subject to the given production function

$$Q = 5K^{1/2}L^{1/2}$$

Find out the equilibrium combination of inputs $K$ and $L$ in order to minimize the cost of production when output $Q = 40$. 11

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