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2 SEM TDC ECOH (CBCS) C 4

2024

(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. Choose the correct option/Answer from the following : 1×8=8

(a) $(AB)' = ?$

(i) $A'B'$

(ii) $B'A'$

(iii) A^{-1}

(iv) None of the above

(b) Which of the following is a singular matrix?

(i) $A = \begin{bmatrix} 2 & 4 \\ 3 & 6 \end{bmatrix}$

(ii) $A = \begin{bmatrix} 4 & 4 \\ 3 & 6 \end{bmatrix}$

(iii) $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(iv) None of the above

(c) The expansion path of C-D production function

(i) intersects X-axis

(ii) intersects Y-axis

(iii) passes through the origin

(iv) None of the above

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

(i) positive

(ii) negative

(iii) independent

(iv) zero

(e) The utility function of a consumer is given by $U = U(x, y) = x^a y^b$. Then $MU_x = ?$

(i) $\frac{bU}{y}$ (ii) $\frac{aU}{x}$

(iii) $\frac{aU}{y}$ (iv) $\frac{bU}{x}$

(f) The elasticity of substitution of C-D production function $Q = AL^\alpha K^\beta$ is

(i) β

(ii) α

(iii) 1

(iv) None of the above

(g) Lagrange function is applied in

(i) unconstrained optimization

(ii) constrained optimization

(iii) Both (i) and (ii)

(iv) None of the above

(h) Define linearly homogeneous production function.

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

(a) Write on the first-order difference equation and its solution.

(b) Solve the following difference equation :

$$y_{t+1} + 3y_t = 10 \text{ with } y_0 = 20$$

(c) Given the C-D production function $Q = AL^{\alpha}K^{\beta}$. Show that it satisfies Euler's theorem.

(d) From the following market model, find the equilibrium quantity demanded $(\overline{Q}_d)$ using Cramer's rule :

$$Q_d = a - bP$$
$$Q_s = -c + dP$$
$$Q_d = Q_s$$

(e) Establish the relationship between average cost and marginal cost using product rule of derivative.

3. (a) (i) Briefly explain the economic applications of first-order difference equation. 4

(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

Or

(b) 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 of P_t and analyse the condition for its convergence and divergence. 11

4. (a) (i) The matrix A is defined as follows :

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

Suppose $f(x) = 2x^2 - 3x + 5$. Find $f(A)$. 4

(ii) State and prove the properties of determinant. 8

Or

(b) (i) The two commodity market models are as follows :

Market—I	*Market—II*
$D_1 = S_1$	$D_2 = S_2$
$D_1 = 25 - 2p_1 + p_2$	$D_2 = 20 + 2p_1 - 2p_2$
$S_1 = -5 + 4p_1$	$S_2 = -10 + 5p_2$

Obtain equilibrium prices $\overline{p}_1$ and $\overline{p}_2$ using Cramer's rule. 6

(ii) Solve the following national income model using matrix inversion technique : 6

$$Y = C + I_0 + G_0$$
$$C = a + bY$$

where Y and C stand for endogenous variables—national income and consumption expenditure, respectively, and I_0 and G_0 represent the exogenously determined investment and government expenditures. The two parameters a and b in the consumption function stand for autonomous consumption expenditure and the marginal propencity to consume $(1 > b > 0)$ respectively.

5. *(a)* State and prove the properties of the CES production function. 11

Or

(b) In a national income model

$$Y = C + I_0 + G_0$$
$$C = a + b(Y - T)$$
$$T = tY$$

where Y, C, I_0, G_0 and T denote income, consumption, investment, government expenditure and income tax

respectively. Analyse the effect of change in autonomous consumption and the rate of tax on equilibrium national income $(\overline{Y})$. 6+5=11

6. *(a)* A monopolist discriminates between two markets. The average revenue functions of two markets and the total cost functions are given by

$$AR_1 = 53 - 4Q_1$$
$$AR_2 = 29 - 3Q_2$$
$$TC = 20 + 5Q$$

such that $Q = Q_1 + Q_2$

Obtain *(i)* profit maximizing outputs (Q_1 and Q_2) and *(ii)* maximum profit. 8+3=11

Or

(b) A monopolist produces his product in two different plants and his total cost functions of the two plants are given by

$$TC_1 = 5 - 2Q_1 + Q_1^2$$
$$TC_2 = 10 - 4Q_2 + 2Q_2^2$$

If the average revenue function is given by $AR = 50 - 2Q$, where $Q = Q_1 + Q_2$, find *(i)* profit maximizing outputs and *(ii)* maximum profit. 8+3=11

7. (a) Given the utility function $U = 2 + x + 2y + xy$ and the budget constraint $4x + 6y = 94$. Find the equilibrium purchase of x and y in order to maximize total utility. 8+3=11

Or

(b) A producer desires to minimize the cost of production $C = 4K + 2L$, where K and L are capital and labour respectively. Subject to the production function $Q = 8K^{\frac{1}{2}}L^{\frac{1}{4}}$, find the equilibrium combination K and L in order to minimize the cost of production when the output is 60. 11

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