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(May)

ECONOMICS

(Major)

Course : 401

(Mathematics for Economics)

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 the following : 1×8=8

   (a) $A \cap A' = ?$

   (i) Ω

   (ii) ϕ

   (iii) A

   (iv) A'

(b) Let A matrix is of dimension $m \times n$ and B matrix is of dimension $o \times p$. Then A and B are conformable for multiplication in the form AB if

(i) $m = p$

(ii) $n = o$

(iii) $n = p$

(iv) $m = o$

(c) Define diagonal matrix.

(d) Mention one property of CES production function.

(e) If $C = 120 - 10q$ is an average cost function, which of the following is its marginal cost for $q = 5$?

(i) 20

(ii) 30

(iii) 25

(iv) None of the above

(Continued)

(3)

(f) Given, $C = 1000 - 0.7Y$, where C is consumption expenditure and Y is National Income. Which of the following is marginal propensity to save (MPS)?

(i) 1

(ii) 0·7

(iii) 0·3

(iv) None of the above

(g) Given $MC = 2aQ + b$. TC is

(i) $bQ + c$

(ii) $aQ^2 + c$

(iii) $aQ^2 + bQ$

(iv) $aQ^2 + bQ + c$

(h) Write the necessary and sufficient conditions for the maximization of a function $y = f(x)$.

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

(a) Write the assumptions of input-output analysis.

(b) Write four properties of determinants.

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(c) Write the meanings of the following : $1\frac{1}{2} \times 2$

 (i) Idempotent matrix

 (ii) Rank of matrix

 (iii) Norms of matrix

(d) The total cost C of a firm is given by

$$C = 1000 + 100q + 80q^2 + \frac{1}{3}q^2$$

Find the value of q at which marginal cost equals average cost.

(e) The marginal revenue function is given by $MR = 50 - 4Q$. Find the point elasticity of demand $Q = 10$.

3. (a) (i) Define the following with examples : $2 \times 4 = 8$

 Unit set; Power set; Proper subset; Intersection of sets.

 (ii) If $A = \{1, 4, 5\}$ and $B = \{4, 9, 10\}$, find $(A \cup B) \setminus (A \cap B)$. 3

Or

(b) (i) Distinguish between relation and function with example. 5

 (ii) Draw the graph of $y = x^2 + 2$. 6

(5)

4. (a) In a three-sector economy, the input coefficient matrix and final demand vector are given below :

$$A = \begin{bmatrix} 0\cdot3 & 0\cdot0 & 0\cdot3 \\ 0\cdot1 & 0 & 0\cdot4 \\ 0\cdot2 & 0\cdot3 & 0 \end{bmatrix} \quad F = \begin{bmatrix} 500 \\ 700 \\ 600 \end{bmatrix}$$

Find the sectoral output X_1, X_2 and X_3. 11

Or

(b) Solve the following National Income model using Cramer's rule :

$$Y = C + I_0 + G_0$$
$$C = \alpha + \beta(Y - T) \quad (\alpha > 0; 0 < \beta < 1)$$
$$T = \gamma + \delta Y \quad (\gamma > 0; 0 < \delta < 1)$$

5. (a) (i) In a perfectly competitive market, the price of a product (q) is ₹ 4 and the total cost (C) of a firm is given by

$$C = q^3 - 15q^2 + 31q + 100$$

Find profit maximizing output and maximum profit. 6

 (ii) Show the relationship among Marginal Revenue, Average Revenue and Price Elasticity of Demand. 6

Or

(b) The production function of a firm is given by

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

where L and K are labour and capital inputs respectively. The cost function is given by $C = 16K + 4L$. Find the least cost capital labour ratio, when $Q = 40$.   12

6. (a) (i) Briefly discuss the uses of integral calculus in economics.   6

(ii) Define producer's surplus. Given the producer's supply function $Q = \sqrt{-4+4P}$ and market price is 10. Find the producer's surplus.

2+4=6

Or

(b) (i) Define marginal propensity to save (MPS). Given MPS function

$$MPS = S'(Y) = 0 \cdot 3 - 0 \cdot 1y^{-\frac{1}{2}}$$

and saving is zero when income is 81. Find the aggregate saving function.   2+4=6

(7)

(ii) Given the marginal cost function

$$C'(Q) = 4Q^2 - 16Q + 25$$

What is the decrease in total cost $C(Q)$ as output produced is reduced from 10 to 5 units?   5

7. (a) (i) Solve the differential equation

$$\frac{dy}{dx} = 5$$ 3

(ii) Analyze the following market model for stability :   8

$$Q_d = 14 - 3P$$
$$Q_s = -10 + 2P$$
$$\frac{dP}{dt} = 4(Q_d - Q_s)$$

Or

(b) (i) Solve the first-order difference equation $y_{t+1} + 3y_t = 2$ and $y_0 = 5$.   4

(ii) Given the demand and supply functions for cobweb model

$$Q_{dt} = 10 - 2P_t$$
$$Q_{st} = -5 + 3P_{t-1}$$

Find the intertemporal equilibrium price and also examine whether you will get stable equilibrium.   7

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