4 SEM TDC ECO M 1

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(May)

ECONOMICS

(Major)

Course : 401

(Mathematics for Economics)

Full Marks : 80
Pass Marks : 32/24

Time : 3 hours

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

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

   (a) Define disjoint sets.

   (b) If $U = \{1, 2, 3, 4, 5, 6\}$ and $A = \{2, 5, 6\}$,
          then find A'.

   (c) If $A = \{1, 2, 3\}$ and $B = \{4, 5\}$, then find
          $A \cup B$.

(*Turn Over*)

(**2**)

(d) $(AB)' = ?$

  (i) $A'B'$

  (ii) $B'A'$

  (iii) AB

  (iv) BA

(e) $\int_a^a f(x)\,dx = ?$

  (i) a

  (ii) 1

  (iii) 0

  (iv) None of the above

(f) Define rank of a matrix.

(g) If the AR function is $AR = 10 - 0\cdot5q$, then identify the MR function.

  (i) $MR = 10 - 0\cdot5q^2$

  (ii) $MR = -0\cdot5q$

  (iii) $MR = 10 - q$

  (iv) $MR = 20 - q$

(Continued)

(**3**)

(h) Given, $TC = aQ^2 + bQ$. MC will be

   (i) $bQ + C$

   (ii) $2aQ + b$

   (iii) $aQ^2 + bQ + C$

   (iv) $2aQ + C$

2. Answer any *four* of the following : $4 \times 4 = 16$

  (a) Find the elasticity of demand when the demand function is

$$q = \frac{20}{p+1} \text{ and } p = 3$$

  (b) Mention four properties of determinants with example.

  (c) Draw the graph $y = 2x^2 - 4x + 1$.

  (d) Solve $y_{t+1} + 3y_t = 10$ with $y_0 = 20$.

  (e) Derive elasticity of substitution for Cobb-Douglas production function.

  (f) Briefly discuss the uses of difference and differential equations in economics.

3. *(a)* *(i)* Define the following with examples :

                              $2 \times 4 = 8$

        Null set, Power set, Union of sets, Proper subset

(4)

(ii) Out of 100 students in a class, 70 students passed in Assamese, 30 students passed in English and 20 students passed in both the subjects. How many students fail in both the subjects?   3

Or

(b) (i) Illustrate the set operations using Venn diagrams.   5

(ii) Define continuity of functions.   2

(iii) Evaluate :   2

$$\underset{x \to 2}{\text{Lt}} \frac{5x^2 - 16}{\sqrt{3x^2 + 4}}$$

(iv) Given, $A = \{2, 4, 6\}$ and $B = \{6, 1\}$. Find $A \cap B$.   2

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

$$A = \begin{bmatrix} 0 \cdot 3 & 0 \cdot 0 & 0 \cdot 3 \\ 0 \cdot 1 & 0 \cdot 0 & 0 \cdot 4 \\ 0 \cdot 2 & 0 \cdot 3 & 0 \cdot 0 \end{bmatrix}, \quad F = \begin{bmatrix} 500 \\ 700 \\ 600 \end{bmatrix}$$

Find the sectoral outputs X_1, X_2 and X_3.   8

(ii) Distinguish between open and closed input-output models.   3

    (*Continued*)

(**5**)

Or

(b) (i) Solve the following national income
model using Cramer's rule : 8

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

(ii) If

$$A = \begin{bmatrix} 5 \\ 6 \\ 3 \\ 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & 2 & 6 & 3 & 5 \end{bmatrix}$$

then find AB. 3

5. (a) (i) The cost function of a firm is

$$C = 300x - 10x^2 + \frac{1}{3}x^3$$

where C stands for cost and x for
output. Calculate the output when
AC is minimum. 6

(ii) Show the relationship among
marginal revenue, average revenue
and price elasticity of demand. 6

(Turn Over)

(**6**)

(b) (i) Give the geometrical interpretation of derivative in case of a single independent variable.   4

(ii) Find the elasticity of demand and MR at $P = 2$, if the demand function $q = 30 - 5p - p^2$.   4

(iii) Using calculus, show the relationship between AC and MC.   4

6. (a) (i) Evaluate :   5

$$\int x e^x \, dx$$

(ii) The MC function of a firm is given by $MC = 6Q^2 - 24Q + 5$. Find the value of Q at which average variable cost is minimum.   6

(b) (i) Given the demand function $P = 8 - 2x$ and supply function $P = 2 + x$. Find the consumer surplus and the producer surplus at equilibrium.   3+3=6

(ii) Derive the average cost and average variable cost functions from the marginal cost function $C = 4 + 7x - 5x^2$, if total fixed cost is 40.   5

(**7**)

7. *(a)* *(i)* Solve :   4

$$\frac{dy}{dx} + 3y = 12$$

(ii) Given

$$\frac{dP}{dt} = 2(Q_d - Q_s)$$
$$Q_d = 12 - 3P$$
$$Q_s = -10 + 2P$$

Find the time path of price P.   7

Or

(b) *(i)* Write a short note on Cobweb model.   4

(ii) Given the demand and supply functions for Cobweb model :

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

Find the time path P_t.   7

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