2016

(1st Semester)

ECONOMICS

(Honours)

Paper No. : ECO-102

[**Quantitative Techniques—I (Mathematics)**]

Full Marks : 70
Pass Marks : 45%

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Given
   $U = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8 \}$
   $A = \{ 1, 3, 5, 7 \}$
   $B = \{ 2, 3, 4, 5 \}$

   Draw Venn diagram to represent the following relationships :   3+3+3=9

   (i) $B - A$

   (ii) B'

   (iii) $(A \cup B)'$

     (*Turn Over*)

(b) Define set. State the two methods of describing a set. 2+3=5

2. (a) Define function and equation. 2+2=4

(b) Solve : $7(x-2)(x-3)-(x-21)(x-14)=24$ 5

(c) A textbook publication finds that the production cost directly attributed to each book is ₹ 40 and the fixed cost is ₹ 20,000. If each book can be sold at ₹ 80, determine the cost function, revenue function and break-even point. 5

UNIT—II

3. (a) Define real number and complex number. 4

(b) Find x, y if $\dfrac{x-4}{4+i}+\dfrac{y}{4-i}=i.$ 6

(c) If $(-3, 4)$ is the centroid of the triangle whose vertices are $(6, 2)$, $(x, 3)$ and $(0, y)$, find x and y. 4

4. (a) Define parabola and hyperbola. 4

(b) Write the real and imaginary parts of the given complex number after putting it in the form of $a+ib$: $(3+4i)^2$ 6

(c) Find the radii and centres of the circle $2x^2+2y^2-4x+6y+3=0.$ 4

UNIT—III

5. (a) Differentiate $y = x^3 e^x \log x$. 4

(b) If a short-run total cost function is given as

$$C = f(Q) = Q^3 - 3Q^2 + 15Q + 27$$

then obtain AC and MC functions. 3+3=6

(c) If $y = 3x^4 + 2x^3 + 4x^2 + 2$, find $\dfrac{d^5 y}{dx^5}$. 4

6. (a) A company has examined the cost structure and has determined that total cost (C), total revenue (R) and the number of units produced (x) are related to $C = 100 + 0 \cdot 015x^2$ and $R = 3x$. Find out the production rate x that will maximize profits of the company. Find out the profit. 6

(b) State (i) Euler's theorem, and (ii) adding up theorem. 2+2=4

(c) Integrate $\int \dfrac{(ax^3 + bx^2 + cx + d)}{x} dx$ 4

UNIT—IV

7. *(a)* If

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

show that $A^2 - 5A + 7I = 0.$ 6

(b) Solve the following by Cramer's rule :   8

$$x - 2y + 3z = 1$$
$$3x - y + 4z = 3$$
$$2x + y - 2z = -1$$

8. *(a)* If

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 7 & 9 \\ -2 & 1 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 4 & 0 & 5 \\ 1 & 2 & 0 \\ 0 & 3 & 1 \end{bmatrix}$$

verify that $(AB)^t = B^t A^t.$ 3+3=6

(b) If

$$A = \begin{bmatrix} 5 \\ 6 \\ 3 \\ 2 \end{bmatrix}_{4 \times 1} \text{ and } B = [1, 2, 6, 3, 5]$$

find $AB.$ 4

(c) Write the properties of a determinant.   4

    (Continued)

UNIT—V

9. *(a)* What do you mean by linear programming? Explain the solutions of linear programming through graphs.

2+4=6

(b) A small-scale manufacturer has production facilities for producing two different products. Each of the products required three different operations, i.e., grinding, assembling and testing. Product *A* requires 15, 20 and 10 minutes for grinding, assembling and testing respectively, whereas product *B* requires 7·5, 40 and 45 minutes for grinding, assembling and testing. The production process requires at least 7·5 hours for grinding, at least 20 hours for assembling and at least 15 hours for testing. If product *A* costs ₹ 60 and product *B* costs ₹ 90 to manufacture, determine the number of each product the firm should produce in order to minimize the cost of production.
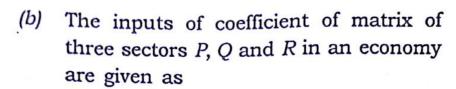
8

10. *(a)* Write the meaning and importance of input-output analysis and its limitations.

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(b) The inputs of coefficient of matrix of three sectors P, Q and R in an economy are given as

$$A = \begin{bmatrix} 0 \cdot 2 & 0 \cdot 6 & 0 \cdot 2 \\ 0 \cdot 3 & 0 \cdot 1 & 0 \cdot 3 \\ 0 \cdot 1 & 0 \cdot 2 & 0 \cdot 2 \end{bmatrix}$$

and final demands are given as

$$F = \begin{bmatrix} 50 \\ 60 \\ 40 \end{bmatrix}$$

Find out the gross output of all the sectors. 8

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