

4/H-16 (iv) (Syllabus-2017)

2022

( May/June )

ECONOMICS

( Honours )

( **Mathematics for Economists** )

Marks : 75

Time : 3 hours

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

Answer **one** question from each Unit

UNIT—I

1. (a) Distinguish between a function and a relation. Explain some of the different functions and their uses in Economics.

4+6=10

- (b) State and prove the associative law of set operations using the following sets : 5

$$A = \{1, 2, 3, 4, 5, 6\}$$

$$B = \{2, 4, 5, 8, 9\}$$

$$C = \{6, 8, 9\}$$

2. (a) The straight line passes through the point  $(1, -2)$  and makes the intercept on the  $x$ -axis which is double the intercept on the  $y$ -axis. Find the equation of the line. Also write down the gradient of the line. 4+1=5

- (b) Find the equilibrium price and quantity for the following market model : 5

$$Q_d = 20 - 3P$$

$$Q_s = -5 + 2P$$

- (c) Explain the difference between homogeneous and homothetic functions with examples. 5

### UNIT—II

3. (a) Define the meaning of a 'skew symmetric' matrix with a suitable example. 2

- (b) For any  $2 \times 2$  matrices  $A$  and  $B$ , prove that—

$$(i) (A+B)' = A' + B'$$

$$(ii) (AB)' = B'A'$$

$$(iii) |A||B| = |AB|$$

3+3+3=9

- (c) If

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

$$\text{find } A^2 - 5A + 7I.$$

4

4. (a) Solve the following simultaneous equations using the matrix inversion method : 9

$$3x - 2y + 3z = 8$$

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

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

- (b) In the Leontief input-output model, explain the concept of the input-output table and the use of the technical coefficient matrix. 3+3=6

## UNIT—III

5. (a) Define 'limit of a variable' and 'limit of a function'. 3

(b) Evaluate the limit of the following functions : 2+2+2=6

$$(i) \lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$$

$$(ii) \lim_{x \rightarrow 0} \frac{\sqrt{2-x} - \sqrt{2+x}}{x}$$

$$(iii) \lim_{x \rightarrow \infty} \frac{(x-1)(2x+3)}{(x+2)(3x+4)}$$

(c) Given

$$f(x) = 4x + 3 \quad \text{for } x > 4 \text{ and } x < 4 \\ = 3x + 7 \quad \text{for } x = 4$$

Examine its continuity at  $x = 4$ . 6

6. (a) Find  $\frac{dy}{dx}$  of the following (any four) : 2×4=8

$$(i) y = \frac{2x^3 - x^2 + x - 2}{x^2}$$

$$(ii) y = e^{\sqrt{x^2 + 3x - 4}}$$

$$(iii) y = (x^2 + 3)(2x^2 + 7)^3$$

$$(iv) 4x^2 + 2xy + y^2 = 12$$

$$(v) y = x^{x+1}$$

(b) Given  $z = x^3 e^{2y}$ , find all the partial derivatives of the second-order and prove that  $f_{xy} = f_{yx}$ . 4

(c) If  $u(x, y) = \log(x + y)$ , then find the total differential of  $u$ . 3

## UNIT—IV

7. (a) Briefly explain the concept of maxima and minima for a given function  $y = f(x)$ . Also explain the point of inflection with the help of a suitable example. 4+3=7

(b) Find the maximum and minimum values of the function  $y = 4x + \frac{1}{x}$ . 4

(c) If total cost  $C = 4x^3 - 3x^2 + 200x$ , find the slope of both the AC curve and the MC curve when  $x = 2$ . Also interpret the meaning of the slope. 3+1=4

8. (a) In a perfectly competitive market, the total cost of a firm is given by  $TC = Q^2 - 6Q + 10$  and the price of the product is 4 per unit. Find the profit maximising output. What are the corresponding values of MC and MR? 5+2+2=9
- (b) For the average revenue function,  $AR = 20 - 2Q$ , find the output level at which TR is maximum. Also show that elasticity of demand is equal to unity at this output level. 4+2=6

## UNIT—V

9. (a) What is integration? Explain its uses in Economics. 1+2=3
- (b) Find the integral of the following (any four) : 3×4=12
- (i)  $\int \frac{2x+2}{(x^2+2x-10)^3} dx$
- (ii)  $\int \sqrt{x} \log x dx$
- (iii)  $\int \sqrt[3]{3x+8} dx$
- (iv)  $\int \frac{x^2-2}{(x-1)(x-2)} dx$
- (v)  $\int (x+2)e^{5x} dx$

10. (a) Prove that

$$\int_1^3 (4x - x^2 - 3) dx = \frac{4}{3} \quad 3$$

- (b) Given demand function  $Q = \sqrt{60 - \frac{3}{2}P}$ . Obtain consumer surplus when  $P = 16$ . 6
- (c) If  $D = 250 - 50P$  and  $S = 25P + 25$  are the demand and the supply functions respectively, find the producer's surplus under equilibrium. 6

\*\*\*