**2024**

( FYUGP )

( 2nd Semester )

# ECONOMICS

( Major )

Paper Code : EC2.CC4

**( Mathematical Methods for Economics—II )**

*Full Marks* : 75
*Pass Marks* : 40%

*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)* Explain the different types of matrices with examples. 10

*(b)* Given

$$A = \begin{bmatrix} 2 & 3 \\ 8 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 7 & 5 & 2 \\ 4 & 8 & 1 \end{bmatrix}$$

find $AB$. 5

**2.** *(a)* Define rank of a matrix. Given

$$A = \begin{bmatrix} 2 & -3 & 4 \\ 1 & 4 & -5 \\ 3 & 1 & 6 \end{bmatrix}$$

find the rank of $A$. 1+4=5

*(b)* Solve the following using Cramer's rule : 10

$$3x + 3y - z = 11$$
$$2x - y + 2z = 9$$
$$4x + 3y + 2z = 25$$

## UNIT—II

**3.** Find the second-order of partial derivatives : 5×3=15

*(i)* $Z = 2x^2 + 5x^2y + xy^2 + y^2$

*(ii)* $Z = 12 - x^2 - y^2 + xy$

*(iii)* $Z = x^2 + 2xy + y^2$

**4.** Find the total differentiation $(du)$ of the following functions : 5×3=15

*(i)* $6x^2 + 8y^2 - 0 \cdot 3xy$

*(ii)* $(x^2 + y^2)(2x^2 - y)$

*(iii)* $\log(x^2 - y^2)$

## UNIT—III

**5.** *(a)* Maximize the production function $y = x_1 x_2$ subject to the budget constraint $x_2 = 6 - 2x_1$ using substitution method. 8

*(b)* Show that the minimum value of $x^2 + y^2 + z^2$ subject to $x + y + z = 1$ is given by $x = y = z = \frac{1}{3}$. 7

**6.** A firm uses three inputs—$K$, $L$ and $R$ to manufacture good $Q$ and faces the production function $Q = 50K^{0.4} L^{0.2} R^{0.2}$. It has a budget of ₹ 24,000 and can buy $K$, $L$ and $R$ at ₹ 80, ₹ 12 and ₹ 10 respectively per unit. What combination of inputs will maximize its output? 15

## UNIT—IV

**7.** *(a)* State the first- and second-order conditions for maximization and minimization. 8

*(b)* Examine $Y = 7 + 20x + 2x^2 - x^3$ for maximum and minimum values. 7

**8.** *(a)* If a firm faces the demand schedule $P = 53 \cdot 5 - 0 \cdot 7q$, what price will maximize profits, if its total cost schedule is $TC = 400 + 35q - 6q^2 + 0 \cdot 1q^3$? 8

(b) A firm uses 200000 units of a component in a year, with demand evenly spread over the year. In addition to the purchase price, each other placed for a batch of components cost ₹ 80. Each unit held in stock over a year costs ₹ 8. What is the optimum order size? 7

## UNIT—V

**9.** Solve the following differential equations : 5×3=15

(i) $\frac{dy}{dx} = 3xy$

(ii) $3x^2 + 2x - 3y\frac{dy}{dx} = 0$

(iii) $(1-x)dy - (1-y)dx = 0$

**10.** (a) What is difference equation? Discuss the application of difference equation in economics. 2+8=10

(b) Show that the solution of the difference equation $aY_{t+1} - bY_t = 0$ is given by $Y_t = \left(\frac{b}{a}\right)^t Y_0$. 5

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