**4/H–16 (iv) (Syllabus–2017)**

**2 0 2 1**

( July )

# ECONOMICS

( Honours )

**( Mathematics for Economist )**

*Marks* : 75

*Time* : 3 hours

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

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

## UNIT—I

**1.** *(a)* Define set. Explain different operations of sets with examples. 2+3=5

*(b)* Given the sets

$A$ {1, 2, 3, 4}

$B$ {2, 4, 5, 6}

$C$ {0, 3, 4, 7, 8}

Prove the De Morgan's law for union and intersection. 4





*(c)* In a class of 25 students of economics and politics, 12 students have taken economics. Out of these 8 have taken economics but not politics. Find the number of students who have taken economics and politics and those who have taken politics but not economics. 3+3=6

**2.** *(a)* Differentiate any *three* of the following with suitable examples : 3×3=9

*(i)* Linear and quadratic functions

*(ii)* Homogeneous and homothetic functions

*(iii)* Explicit and implicit functions

*(iv)* Domain and range of a function

*(b)* Find the equation of the straight line passing through the points (3, –2) and (–4, 1). Also write down the gradient of the line. 4+2=6

## UNIT—II

**3.** *(a)* What is matrix? Mention some of its properties. 1+5=6

*(b)* Solve the given simultaneous equations by matrix inversion method : 9

$2x_1 \quad 3x_2 \quad x_3 \quad 15$

$4x_2 \quad 2x_3 \quad 16$

$3x_1 \quad 2x_2 \quad 18$

**4.** *(a)* State the Hawkins-Simon conditions for input/output analysis. What are its implications? 3+2=5

*(b)* Prove that $(ABC)^T \quad C^T B^T A^T$. Given

$$A \quad \begin{matrix} 2 & 1 \\ 4 & 2 \end{matrix}, \quad B \quad \begin{matrix} 3 & 0 \\ 1 & 5 \end{matrix}, \quad C \quad \begin{matrix} 1 & 2 \\ 2 & 3 \end{matrix}$$

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*(c)* If

$$A \quad \begin{matrix} 8 & 4 \\ 3 & 7 \end{matrix}, \quad B \quad \begin{matrix} 3 & 2 \\ 1 & 5 \end{matrix}$$

find the matrix $C$, such that $2A \quad 4B \quad 3C \quad 0$, where 0 is a null matrix. 3

*(d)* Find the value of $k$, if $A$ is a singular matrix : 3

$$A \quad \begin{matrix} 2 & 3 & 8 \\ 4 & 5 & k \\ 2 & 2 & 2 \end{matrix}$$

UNIT—III

**5.** *(a)* Evaluate (any *three*) : 3×3=9

*(i)* $\lim\limits_{x \quad 2} \dfrac{x^2 \quad 4}{x \quad 2}$

*(ii)* $\lim\limits_{x \quad a} \dfrac{\sqrt{x} \quad \sqrt{a}}{x \quad a}$





*(iii)* $\lim\limits_{x} \dfrac{5x^3 \quad 2}{3x^3 \quad x \quad 1}$

*(iv)* $\lim\limits_{x \quad 2} \dfrac{x^2 \quad 6x \quad 8}{x^2 \quad 7x \quad 10}$

*(v)* $\lim\limits_{x \quad 0} \dfrac{\sqrt{1 \quad x} \quad \sqrt{1 \quad x}}{x}$

*(b)* What makes a function continuous? Given the function

$$\begin{matrix} f(x) & 3 \quad 2x & \text{for} & 3/2 \quad x \quad 0 \\ & 3 \quad 2x & \text{for} & 0 \quad x \quad 3/2 \\ & 3 \quad 2x & \text{for} & x \quad 3/2 \end{matrix}$$

Is the function continuous at $x \quad 0$? 2+4=6

**6.** *(a)* Differentiate any *four* of the following functions : 2×4=8

*(i)* $y \quad (2x \quad 5)(x^2 \quad x \quad 1)$

*(ii)* $y \quad (2x^2 \quad 7)^{10}$

*(iii)* $y \quad \sqrt{x^2 \quad 5x}$

*(iv)* $y \quad \dfrac{x^2 \quad 7}{x^2 \quad 7}$

*(v)* $x^3 \quad 3xy \quad 5y \quad 6 \quad 0$

*(vi)* $y \quad x^x$

(*b*) Find the first- and second-order partial derivatives of the following function :

$$z \quad 2x^3 \quad 5x^2y \quad xy^2 \quad y^2$$

Verify that

$$\frac{{}^2 z}{x \; y} \qquad \frac{{}^2 z}{y \; x}$$ 4

(*c*) $u \quad (3x^2 \quad 5y^2)^5$. Find $du$. 3

UNIT—IV

**7.** (*a*) State the necessary and sufficient conditions for maximum and minimum values, and hence find the maximum and minimum values of the function $y \quad \frac{1}{3}x^3 \quad 3x^2 \quad 8x \quad 10$. 2+4=6

(*b*) The demand equation for a manufacturer is given by $P \quad 500 \quad 2q$, and his average cost function is $0 \; 25q \quad 4 \quad \frac{400}{q}$, where $q$ is output and $p$ is price. Determine—

(*i*) the level of output at which profit is maximized;

(*ii*) the price at which this occurs;

(*iii*) the maximum profit. 4+3+2=9





**8.** (*a*) The total cost associated with producing and marketing $x$ units of an item is given by

$$C \quad 0 \; 005x^3 \quad 0 \; 02x^2 \quad 30x \quad 3000$$

Find AC at 10 units of output and MC at 3 units of output. 3+3=6

(*b*) The demand function is given by $q \quad \frac{20}{p \quad 3}$. Calculate price elasticity of demand at price $p \quad 2$ and also interpret the result. 7+2=9

UNIT—V

**9.** (*a*) What is integration? Why is there a constant of integration? 1+2=3

(*b*) Find the integral of the following (any *four*) : 3×4=12

(*i*) $4x^3 \quad \frac{1}{\sqrt{x}} \quad 3 \;\; dx$

(*ii*) $4(e^{2x} \quad x)(e^{2x} \quad x^2)^2 \, dx$

(*iii*) $\frac{8x}{(2x^2 \quad 1)} dx$

(*iv*) $x^2 e^{x} dx$

(*v*) $x \;\; \log x \, dx$

(*vi*) $10^{\quad x} dx$

**10.** *(a)* Evaluate : 3

$$ {}_{2}^{4} 3x^2 (x^2 \quad 1)\, dx $$

*(b)* What is producer's surplus? If the production function is given by $Q \quad \sqrt{4 \quad 4p}$ and the market price is 10, find the producer's surplus. 2+4=6

*(c)* The demand and supply functions are $P_d \quad (6 \quad q)^2$ and $P_s \quad 14 \quad q$ respectively. Find the consumer's surplus under perfect competition. 6

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