

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

2019

( April )

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) State and prove distributive law of set operations using the following sets : 5

$$A = \{4, 5, 6\}$$

$$B = \{3, 4, 6, 7\}$$

$$C = \{2, 3, 6\}$$

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- (b) Out of 400 boys of a school, 112 played cricket, 120 played hockey and 168 played football. Of these, 32 played both football and hockey; 40 played cricket and football and 20 played cricket and hockey; 12 boys played all the games. How many boys did not play any game? How many played only one game? 3+3=6
- (c) What is a power set? Enumerate the subsets of the set  $A = \{1, 3, 5\}$ . 2+2=4
2. (a) Plot the following functions : 2½×2=5
- (i)  $y = 3 + 2x$
- (ii)  $y = x^2 + 3x - 4$
- (b) Explain the concepts of exponential and logarithmic functions with examples. 5
- (c) When the price of a certain commodity was ₹ 2 per unit, 10 units were supplied in the market. When it went up to ₹ 4, the supplier supplied 40 units to the said market. Obtain the linear supply function. Also predict the supply on a future price of ₹ 3. 5

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UNIT-II

3. (a) If  $A = \begin{bmatrix} 4 & 1 & 0 \\ 1 & -2 & 2 \end{bmatrix}$ ,  $B = \begin{bmatrix} 2 & 0 & -1 \\ 3 & 1 & 4 \end{bmatrix}$ ,  $C = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$  find a matrix  $X$  such that  $(3B-2A)C+2X=0$ . 5
- (b) What is an idempotent matrix? Show that matrix  $A$  is idempotent
- $$A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix} \quad 2+8=10$$
4. (a) Given  $A = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$ ,  $B = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$  Prove that the transpose of the product of  $A$  and  $B$  is equal to the product of transposes of  $B$  and  $A$ . 6
- (b) Find the solution of the following equation systems using matrix inverse method : 9
- $$\begin{aligned} x+2y+3z &= 11 \\ 2x-y+4z &= 13 \\ 3x+4y-5z &= 3 \end{aligned}$$

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UNIT-III

5. (a) Define limit of a function. 3
- (b) Evaluate any two of the following : 3×2=6
- (i)  $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x - 3}$
- (ii)  $\lim_{x \rightarrow 0} \frac{\sqrt{1+2x} - \sqrt{1-3x}}{x}$
- (iii)  $\lim_{x \rightarrow \infty} \frac{2-x-3x^2}{4x^2+3x+1}$
- (c) Given the function
- $$f(x) = \begin{cases} 4x^2 - 3x & \text{when } 1 < x < 2 \\ 3x + 4 & \text{when } x \geq 2 \end{cases}$$
- Is the function continuous at  $x=2$ ? 6
6. (a) Differentiate any three of the following functions : 2×3=6
- (i)  $y = (x^2 + 4)(2x^3 - 6)$
- (ii)  $y = \log \left( \frac{x^2 + 5}{x^2 - 5} \right)$
- (iii)  $y = e^{(3x + \sqrt{x^2 - 4} + 6)}$
- (iv)  $x^{1/2} + y^{1/2} = a^{1/2}$

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- (b) Given the function  $u = \frac{x-y}{x+y}$ . Show that

$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0 \quad 5$$

- (c) Find the total differential of  $z = \sqrt{5x^2 + y^2}$  4

UNIT-IV

7. (a) Explain the concepts of maxima and minima of a function  $y=f(x)$  using appropriate diagram. Also state the necessary and sufficient conditions. 3+2=5
- (b) The demand function of a monopolist is given by  $q=400-2p$ , and his average cost function by  $AC=5+\frac{q}{50}$ , where  $p$ = price and  $q$ = quantity. Derive the equilibrium price and output. 10
8. (a) The total cost  $C$  as a function of quantity produced  $Q$  is given by
- $$C = \frac{1}{10}Q^2 + 5Q + 200$$
- Find the minimum value of the average cost function. Show that at this demand  $AC = MC$ . 8

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- (b) Calculate the price elasticity of demand of the following demand function
- $$D = 100 - 2P + 0.004P^2$$
- when  $P=10$ . 4
- (c) If MR is ₹ 26 and the elasticity of demand with respect to price is ₹ 3, find AR. 3
- UNIT-V
9. (a) What is integration? 3
- (b) Find the integral of the following (any four) : 3×4=12
- (i)  $\int \left( x^2 + \sqrt{x} - \frac{1}{x^2} \right) dx$
- (ii)  $\int a^x \left( 1 + \frac{a^{-x}}{x^5} \right) dx$
- (iii)  $\int \frac{(\log x)^2}{x} dx$
- (iv)  $\int \frac{2x-1}{(x-1)(x-2)} dx$
- (v)  $\int x^2 e^x dx$

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10. (a) What are the properties of definite integral? 5
- (b) Evaluate  $\int_{-1}^1 (2-3x)^3 dx$  4
- (c) The supply functions of a certain market is  $P=10+2q$ . When the equilibrium price ( $P_0$ ) for the product is ₹ 20, calculate the producers surplus. 6

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