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

$A = \{4, 5, 6\}$
$B = \{3, 4, 6, 7\}$
$C = \{2, 3, 6\}$

(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

(Continued)

UNIT—II

3. (a) If

$$A = \begin{bmatrix} 4 & 1 & 0 \\ 1 & -2 & 2 \end{bmatrix}, \quad B = \begin{bmatrix} 2 & 0 & -1 \\ 3 & 1 & 4 \end{bmatrix}, \quad C = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$$

find a matrix X such that $(3B - 2A)C + 2X = 0$. 5

(b) What is an idempotent matrix? Show that matrix A is idempotent

$$A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$$ 2+8=10

4. (a) Given

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$$

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

$$x + 2y + 3z = 11$$
$$2x - y + 4z = 13$$
$$3x + 4y - 5z = 3$$

(Turn Over)

UNIT—III

5. *(a)* Define limit of a function. 3

(b) Evaluate any *two* of the following : $3\times2=6$

(i) $\lim\limits_{x\to3}\dfrac{x^3-27}{x-3}$

(ii) $\lim\limits_{x\to0}\dfrac{\sqrt{1+2x}-\sqrt{1-3x}}{x}$

(iii) $\lim\limits_{x\to\infty}\dfrac{2-x-3x^2}{4x^2+3x+1}$

(c) Given the function

$$f(x) = 4x^2-3x \quad \text{when} \quad 1<x<2$$
$$= 3x+4 \quad \text{when} \quad x\geq2$$

Is the function continuous at $x=2$? 6

6. *(a)* Differentiate any *three* of the following functions : $2\times3=6$

(i) $y=(x^2+4)(2x^3-6)$

(ii) $y=\log\left(\dfrac{x^2+5}{x^2-5}\right)$

(iii) $y=e^{(3x+\sqrt{x^2-4}+6)}$

(iv) $x^{1/2}+y^{1/2}=a^{1/2}$

(Continued)

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

$$x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=0$$ 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 $AC=5+\dfrac{q}{50}$, 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

(Turn Over)

(b) Calculate the price elasticity of demand of the following demand function

$$D = 100 - 2P + 0 \cdot 004P^2$$

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*) : $3 \times 4 = 12$

(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) $\int x^2 e^x \, dx$

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

★★★

(Continued)