Odd Semester, 2020

(Held in March, 2021)

ECONOMICS

(Honours)

(Mathematics)

Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking at least **one** from each Unit

UNIT—I

1. (a) Find the equation of a straight line passing through the points (3, 2) and (–1, 4). 3

(b) In a town, 45% read magazine *A*, 55% read magazine *B*, 40% read magazine *C*, 30% read magazines *A* and *B*, 15% read magazines *B* and *C*, 25% read magazines *C* and *A* and 10% read all the three magazines. Find what percentage do not read any magazine. What percentage read exactly two of the magazines? 5

(c) What is a power set? Give examples. 2

(d) State and prove De Morgan's rule of set union and set intersection. 5

2. (a) Define a function. What are the different types of functions? Explain some of their uses in Economics. 2+4+4=10

(b) Define a homogenous function. Show that the function

$$z = f(x, y) = x^3 + 3x^2y + 3xy^2 + y^3$$

is homogenous of degree 3. 2+3=5

UNIT—II

3. (a) Explain any three properties of determinants providing examples. 6

(b) Solve the following by using Cramer's rule : 9

$$2x - 4y + 3z = 3$$
$$4x - 6y + 5z = 2$$
$$-2x + y - z = 1$$

4. (a) Define the concept of linear programming. What are the essential components of a linear programming problem? 2+3=5

(b) A factory has 90, 80 and 50 running feet, respectively, of teak, pinewood and rosewood. Product *A* requires 2, 1 and 1 running feet and product B requires 1, 2 and 1 running feet of teak, pinewood and rosewood, respectively. If *A* could sell for ₹ 48 and *B* could sell for ₹ 40 per unit, how much of each should be produced and sold to maximise gross income out of his stock of wood? Give a mathematical formulation of this linear programming problem and solve by graphical method. 5+5=10

UNIT—III

5. (a) Evaluate the limit of the following : 2×4=8

(i) $\underset{x \to a}{\text{Lt}} \dfrac{3x^2 - 5x^{-1}}{2x^2 + 7x^{-2}}$

(ii) $\underset{x \to 0}{\text{Lt}} \dfrac{\sqrt{(a+x)} - \sqrt{(a-x)}}{3x}$

(iii) $\underset{h \to 0}{\text{Lt}} \dfrac{(x+h)^3 - x^3}{2h}$

(iv) $\underset{x \to a}{\text{Lt}} \dfrac{x^9 - a^9}{x^6 - a^6}$

(b) State the conditions for continuity of a function at a point $x = a$. 4

(c) Distinguish between 'limit of a variable' and 'limit of a function'. 3

6. (a) Find $\dfrac{dy}{dx}$ for the following : 2×3=6

(i) $y = \sqrt{\dfrac{1-x}{1+x}}$

(ii) $(2x^2 + 3)e^{-3x^2}$

(iii) $y = e^{\log x}$

(b) Find the total differential of $z = \sqrt{x+y}$. 3

(c) Find the first- and second-order partial derivatives of

$$z = \frac{x+y}{2x+5y}$$

also verify that $\dfrac{\partial^2 z}{\partial x \partial y} = \dfrac{\partial^2 z}{\partial y \partial x}$. 6

UNIT—IV

7. (a) Integrate the following functions : 2×5=10

(i) $\int (2e^{2x} - 4^x + 4x^3)\,dx$

(ii) $\int (3(7-6x)^3)\,dx$

(iii) $\int \dfrac{5}{5-3x}\,dx$

(iv) $\int \frac{1}{x} \log x \, dx$

(v) $\int_0^{5/3} (x^2 - 3x + 6) \, dx$

(b) Explain the difference between definite and indefinite integrals with examples. 5

8. (a) Explain the uses of integration in Economics. 4

(b) Given the demand function

$$Q = \sqrt{60 - \frac{3}{2}P}$$

where Q is quantity demanded and P is price; obtain consumer surplus when $P=16$. 6

(c) Given the producer's supply function $x = \sqrt{-4 + 4P}$ and market price is 10; find producer's surplus. 5

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