MATHEMATICAL FOUNDATION-I

Note : Attempt five questions in all, selecting *one* question from each unit in addition to compulsory **Question No. 1**. All questions carry equal marks.

Compulsory Question

1. (a) Write down all subset of $\{1, 2, 3\}$ 3

 (b) Solve $\dfrac{d^2y}{dx^2} + 4y = 0$

 (c) Find n^{th} derivative of $\sin(2x + 1)$.   3

 (d) Define order and degree of differential equation.   3

 (e) Define lattice.   2

 (f) Define Equivalence relation on set.   2

UNIT-I

2. (a) Which of the following lattices are Boolean algebras.

 (i) D_6

(ii) D_{12}

(iii) D_{20}

(iv) D_{99} 8

(b) A polygon has 44 diagonals. Find the number of its sides. 8

3. (a) Prove that $A - (B \cup C) = (A - B) \cap (A - C)$ 8

(b) Define set, subset, Power set, compliment of a set. 8

UNIT-II

4. (a) Show that $\lim_{x \to 0} \dfrac{e^{1/x}}{e^{1/x} + 1}$ does not exist. 8

(b) If $e^x + e^y = e^{x+y}$. Find $\dfrac{dy}{dx}$. 8

5. (a) Using $\in - \delta$ method definition prove that $\cos^2 x$ is a continuous function. 8

(b) Find n^{th} derivative of $\dfrac{x}{1 - 3x + 2x^2}$ 8

UNIT-III

6. (a) Find the differential equation of the system of circles touching x-axis at the origin. 8

(b) Solve $(x^2 + y^2 + 2x)\, dx + 2y\, dy = 0$ 8

7. (a) Solve $y.dx - (x + 2y^2)\, dy = 0$

(b) Solve $(\tan^{-1} y - x)\, dy = (1 + y^2)\, dx$. 8

UNIT-IV

8. (a) Solve $\dfrac{d^2 y}{dx^2} + 4y = x \sin x$ 8

(r) Solve $\dfrac{d^2 y}{dx^2} + y = \sec x$ 8

9. (a) Solve $x^2 \dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + y = \dfrac{1}{(1-x)^2}$ 8

(b) Solve $\dfrac{d^2y}{dx^2} + y = \sin x \cos 2x$ 8