Content

Unit 1 Limit and Continuity (c)

Unit 2 Differentiation

Unit 3 Application of Differentiation

Unit 4 Integration and Its Application

Unit 5 Differential Equations

Unit 6 Computational Method

1

UNIT

Limit and Continuity

1.1 Introduction

Limit is the fundamental concept of calculus. In real sense, calculus is the study of limits. It was developed independently by Sir Isaac Newton (1642 – 1727) and Gottfried Whilhelm Leibnitz (1646–1716). Intuitively, limit is a value to which a function approaches as the variable approaches a given value. The limit has many applications in calculus as well as in other branches of Mathematics.

We have discussed about a function and its graph in first semester. We now give the definition of function, domain and range of a function and value of the function at a point as a review.

Function

Let X and Y be two non-empty sets. A function f from a set X to set Y is a rule which associates each element of X with a unique element of Y. The set X is called the **domain of f** and the set of values of $f(x)$ for every $x \in X$ is called the **range of f** and the set Y is called the **co-domain of f**. In symbol, we write $f: X \rightarrow Y$ in order to mean f is a function from X to Y.

Value of a Function

Let $f: X \rightarrow Y$ be a function and $x = a$ be an element in X. The value of $f(a)$ is called the value of the function f at $x = a$. If $f(a)$ is a finite number then we say that $f(x)$ exists or is defined at $x = a$. If $f(a)$ is not finite, we say $f(x)$ does not exist or is not defined at $x = a$.

Examples:

(i) The function $f(x) = 2x + 1$ is defined at $x = 2$ since

$$f(2) = 2 \times 2 + 1$$
$$= 5 \text{ which is a finite number.}$$