Unit 1 Relevance of Mathematics

1.0 Unit Objectives:

By the end of this Unit, learners should be able to understand:

- Importance of mathematics
- Need of studying different topics from mathematics
- Role of mathematics in computer applications
- Use of mathematics in describing and reasoning about computational systems
- The fundamental concepts and skills necessary for understanding computer science

1.1 Unit Introduction:

Mathematics is often defined as the study of quantity, pattern, change, and space. Some people call mathematics the study of "figures and numbers ", but this is an oversimplification. It is the investigation of axiomatically defined abstract structures using logic and mathematical notation. In fact, it is the investigation of objects or concepts that exist independently of our reasoning about them. Due to its applicability in practically every scientific discipline, mathematics has been called “the language of science",

1.2 Purpose of this course:

A mathematics course has more than one purpose. The main purpose of this course is to teach basic concepts from mathematics that are needed in the study of computer science. This course is a prerequisite for many of the computer sciences courses. As the main purpose is to learn the necessary mathematics, the course is to be studied from a computer science viewpoint.

There is no specific knowledge required other than some elementary topics from school level mathematics. Almost all topics and techniques introduced here will be needed while studying computer science. This course will also help the students to develop their general ability to think abstractly and their problem solving skills also.

1.3 Some facts about Computers:

A computer is a machine for manipulating data according to a list of instructions known as a program. Originally, the term "computer" referred to a

person who performed numerical calculations, often with the aid of a calculating device.

Although the electronic computer is of recent origin (some 50 years), the idea of automating the process of computation was born long back, probably, when book-keeping, accounting and astronomy became tedious.

The first actual calculating mechanism known to us is the abacus. The origins of the abacus are disputed, as many different cultures have been known to have used similar tools. But these early computing machines were definitely used for numerical calculations.

Computer science has a much closer relationship with mathematics than many scientific disciplines. Early computer science was strongly influenced by the work of mathematicians such as Kurt Godel and Alan Turing.

Charles Babbage (1791 AD – 1871 AD) is many times referred as the "Father of computer ".He was an English mathematician, analytical philosopher, mechanical engineer who originated the idea of a *programmable* computer. Babbage's machine could be programmed to follow a series of steps, where each step could be a combination of four basic operations addition, subtraction, multiplication and division. But more important was the fact that the machine had decision making capability. It could change the order of calculation depending on the value of a certain quantity, which it had computed. This first computer was also mainly useful for mathematical calculations.

1.4 Role of mathematics in computer applications:

Despite its name, much of computer science does not involve the study of computers themselves. Study of different branches of mathematics helps in studying computer science.

In analysis and design of algorithms, Graph Theory is used more often than any other branch of mathematics. A weighted directed graph, in which vertex represents program block and each edge represents possible transfer of control from one block to another, is useful representation of a computer program. It is also used for Time analysis, segmentation of program and in detecting common type of errors

Cryptography is considered as a discipline of algebra concerned with information security, and related issues, particularly encryption, authentication and access control. Its purpose is to hide the meaning of a message rather than its existence. In modern times, it has also branched out into computer science.

1.5 The course aims:

This mathematics course starts with fundamental concepts like Set Theory, Mathematical Induction, Number systems, Exponents, Logarithms, Permutations and combinations. Then it covers the topics which are useful in computer science such as Logic, Relations, Functions and Graph Theory.
It also covers the topics like Vectors, Matrices and Determinants, Mensuration, Linear Equations and Polynomials which will be helpful to the students .

1.6 Summary for Unit 1