

## Algorithms and Computations

Programme(s) in which it is offered: B.Sc.B.Ed. Mathematics

<b>Course Category:</b> Elective	<b>Schedule of Offering:</b> Odd
<b>Course Credit Structure:</b> 3	<b>Course Code:</b> MTH3122
<b>Total Number of Hours:</b> 4	<b>Contact Hours Per Week:</b> 4
<b>Lecture:</b> 2, 2	<b>Tutorial:</b> 1, 2
<b>Practical:</b> 0, 0	<b>Medium of Instruction:</b> English
<b>Date of Revision:</b>	<b>Skill Focus:</b> Employability
<b>Short Name of the Course:</b> Algorithms & Computations	<b>Course Stream:</b>
<b>Grading Method:</b> Regular	<b>Repeatable:</b> Credit
<b>Course Level:</b> Intermediate	

### Course Description

This course is an elective course for B.Sc. B.Ed. Mathematics students. This course focusses on the basic concepts and applications of algorithms in mathematics and computer science. The course also discusses complexities and strategies.

### Course Introduction

This course aims at introducing students to the basic theory and applications of algorithms. It discusses certain important algorithms from the field of numerical analysis and graph theory, and their applications in various other fields. The course also introduces the students to computations and algorithm complexities, and a few examples of NP hard problems.

### Course Objective

The objectives of the course are:

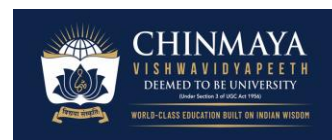
1. To introduce the basics of computers and languages to the students
2. To familiarise students with the nature and uses of algorithms
3. To discuss applications of numerical algorithms in solving problems
4. To discuss applications of graph-theoretic algorithms in solving real life problems
5. To explore strategies of computation such as greedy technique, and divide and conquer techniques

### Course Outcome

At the end of the course students will be able to

1. Describe the salient features of an algorithm and illustrate
2. State and apply numerical algorithms to solve a system of simultaneous linear equations
3. State and apply numerical algorithms to interpolate a given set of data
4. State and apply graph-theoretic algorithms to find shortest path and shortest distance between two points
5. Analyse the complexities in algorithms and computation
6. Describe and apply greedy technique, and divide and conquer techniques in computations

Version No:  
Approval Date:



## PO-CO Mapping

**PO-CO Mapping Matrix**

CO/PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

### Prerequisites and other constraints

This course is offered to all students of B.Sc.B.Ed. Mathematics. There is no prerequisite course.

### Pedagogy

The teaching-learning of the course is organized through lectures, problem-solving sessions and student presentations.

### Suggested Reading:

1. Conte and Boor (1985). Numerical Algorithms. McGraw-Hill.
2. Deo (1987). Graph Theory with Applications to Engineering and Computer Science. Prentice Hall of India.
3. Krishnamurthy (1980). Introductory Theory of Computer Science, Prentice Hall of India.
4. Horowitz and Sahni (1987). Fundamentals of Computer Algorithms. Addison Wesley.
5. Rajaraman V (1980). Computer Oriented Numerical Methods. Prentice Hall of India.
6. Thulasiraman and Swamy (1992). Graphs: Theory and Algorithms. John Wiley.
7. Arora and Barak (2017). Computational Complexity. Cambridge English.

### Evaluation Pattern

**Evaluation Matrix**

	Component Type	Weightage Percentage	Total Marks	Tentative Dates	Course Outcome Mapping
<b>Continuous Internal Assessment (CIA) Components*</b>	Mid-semester exam	50% of CIA	15	Around 9 <sup>th</sup> week	1, 2
	Assignment	25% of CIA	7.5	End of each module	1, 2, 3, 4, 5, 6
	Quizzes/Problem Solving	17% of CIA	5	Every two weeks	1, 2, 3, 4, 5
	Presentations	8% of CIA	2.5	End of two modules	1, 2, 3, 4, 5, 6
	CIA Marks	100% of CIA (to be converted to 30%)	30		
	<b>ESE</b>	<b>70%</b>	<b>70</b>	End of the semester	1, 2, 3, 4, 5, 6

## Module Sessions

### Module 1: Introduction to Computers (15 hours)

Introduction to Computers, Flowcharts, Algorithms and their features, Languages, Types of language and translators. Numerical Algorithms - Solving a simultaneous system of linear equations using iterative and direct methods.

#### Reading:

1. Krishnamurthy
2. Horowitz
3. Rajaraman

#### Activities:

- a. Quiz
- b. Assignment

### Module 2: Interpolation algorithms (15 Hours)

Interpolation algorithms - equal, unequal intervals, central difference and inverse interpolation. Numerical differentiation and integration, and their error calculations.

#### Reading:

1. Conte
2. Rajaraman

#### Activities:

- a. Quiz
- b. Assignment
- c. Presentation

### Module 3: Graph Theoretical Algorithms (15 Hours)

Graph theoretical algorithms - Connectivity, finding shortest path between two vertices, enumeration of all paths, Construction of minimum spanning tree, Cutset, Cut vertex, coding and decoding.

#### Reading:

1. Deo
2. Thulasiraman

#### Activities:

- a. Quiz
- b. Assignment

### Module 4: Computation (15 Hours)

Computation - Algorithm complexities, Strategies, Divide and conquer, Greedy technique, Introduction to NP hard problems.

#### Reading:

1. Harowitz
2. Arora

#### Activities:

- a. Quiz
- b. Assignment
- c. Presentation