

**Anekant Education Society's  
Tuljaram Chaturchand College of Arts, Science and  
Commerce, Baramati**

**Autonomous**

**Short Term Certificate Courses  
Department of Mathematics**

<b>Sr. No.</b>	<b>Certificate Course</b>	<b>No. of Credits</b>	<b>Course Coordinator</b>	<b>Audience</b>
1	Mathematics in Science	2	Sadashiv Puranik	BSc (Mathematical sciences, Biological sciences), BSc (Comp), students
2	Introduction to Fuzzy Mathematics	2	Prakash Fulari	PG Maths students
3	SAGE software for Algebraic and Geometrical Concepts	2	Shaila Jadhav	Science students UG and PG

# Certificate Course Title: Mathematics in Science

## [A] Learning Objectives:

- To apply Mathematics as a tool to solve problems in Physical, Biological, and Computer science
- To understand how applied Mathematics can work in industry, laboratories.
- To study examples of applied Mathematics in everyday life

## [B] Learning Outcome:

- Students will be able to use Mathematics as a tool by modeling and analyzing practical problems.
- Students will understand the relation between applied and pure Mathematics

## Syllabus/Content:

### Unit 1: Introduction to Applied Mathematics?

[2 Theory]

- What is Applied Mathematics?
- The Language of Applied Mathematics?

### Unit 2: Areas of Applied Mathematics

[4 Theory+ 2 Practicals]

- Calculus
- Ordinary Differential Equations
- Partial Differential Equations
- Linear Algebra

### Unit 3: Modelling

[2 Theory+ 1 Practical]

- Medical Imaging
- The Spread of Infectious Diseases

### Unit 4: Examples

[2 Theory+ 2 Practicals]

- Examples from Biological Sciences
- Examples from Computer Sciences
- Examples from Physical Sciences

## Reference Books:

- The Princeton Companion to Applied Mathematics, Higham, Princeton University Press
- Elementary Mathematical Models: An Accessible Development without Calculus, Second Edition, American Mathematical Society

## Syllabus for Certificate Course 2

**Class:** PG Maths students

**Course Title:** Introduction to Fuzzy Mathematics

**Credit:** 2

**No. of lectures:** 30 (12 theory + 18 Practical).

### [A] Learning Objectives:

- To know the fundamentals of fuzzy algebra.
- To know the basic definitions of fuzzy theory.

### [B] Learning Outcome:

- Decide the difference between crisp set theory and fuzzy set theory.
- Gain the methods of fuzzy logic
- Make applications on fuzzy logic membership function.

### TOPICS/CONTENTS:

#### Unit 01: Fuzzy Set Theory

[4 Theory+ 4 Practical = 8 Lectures]

##### Fuzzy Set Theory

- 1.1 Introduction
- 1.2 Concept of a fuzzy set
- 1.3 Operations on fuzzy sets
- 1.4 Certain numbers associated with a fuzzy set

#### Unit 02: Fuzzy Relations

[4 Theory+ 4Practical = 8 Lectures]

- 2.1 Fuzzy relations
- 2.2 Operations on fuzzy relations
- 2.3  $\alpha$ -cuts of fuzzy relations
- 2.4 Composition of a fuzzy relation

**Unit 03: Fuzzy Logic****[3 Theory+ 5 Practical = 8 Lectures]**

3.1 Three-valued logic

3.2 N-valued logic

3.3 Fuzzy propositions and their interpretations

3.4 Fuzzy rule and their interpretations

**Unit 04: Applications****[1 Theory + 5 Practical = 6 Lectures]**

4.1 Fuzzy methods in Control Theory

4.2 Fuzzy methods in Decision Making

**Mode of Evaluation: Written and Practical Examination****Text Book:**

M. Ganesh, "Introduction to Fuzzy Sets and Fuzzy Logic", PHI Learning  
(Eastern Economy Edition)  
Chapters: 6, 7, 8 and 9.

**Reference Books:**

- 1) S. Nanda and N. R. Das, "Fuzzy Mathematical Concepts", Narosa Publishing House, New Delhi, 2010.
  - 2) H. J. Zimmermann, "Fuzzy set theory and its Applications", Allied Publishers Ltd., New Delhi, 1991.
  - 3) T. J. Ross, "Fuzzy Logic with Engineering Applications", John Wiley & Sons.
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# Syllabus for Certificate Course 3

**Class:** Science students UG and PG maths students.

**Course Title:** Certificate Course in SAGE software for Algebraic and Geometrical Concepts

**Credit:** 2

**No. of lectures:** 30 (12 theory + 18 Practical).

## [A] Learning Objectives:

- To use open source software Sage as aid to explore topics in Calculus, Applied Linear Algebra along with several applications.
- To understand how software can be useful to do time consuming calculations and problem solving in Mathematics

## [B] Learning Outcome:

- Use of software in Mathematics, Solving of problems, learn to make programs.
- Students are able to attempt practical problems in a suitable Industry for real world solutions.
- Students are able to applying mathematics in computers such as use of matrices in image processing and other related subjects.

## TOPICS/CONTENTS:

### Unit 01: Introduction

[2Theory = 2Lectures]

1.1 Installation of Sage Math

1.2 Some basic commands

1.3 Equality and arithmetic operations.

### Unit 02: Basic algebra

[2 Theory+ 3Practical = 5 Lectures]

2.1 Integer operations

2.2 GCD, LCM

2.3 Practical on Solving Equations in Sage Math

2.4 Exploring integers

2.5 elimination methods

### **Unit 03: Basic Calculus**

[2 Theory+ 3Practical = 5 Lectures]

3.1 Function representation and operations

3.2 2D Plotting

3.3 Practical on function operations

3.4 Two dimensional plotting

### **Unit 04: 3D Plotting**

[2 Theory+ 4Practical = 6Lectures]

4.1 Parametric representation of graph

4.2 Implicit graph

4.3 Practical's on 3dimensional plotting and its type

### **Unit 05: Differentiation**

[2 Theory+ 4Practical = 6Lectures]

5.1 Derivative of functions

5.2 Integration

5.3 Practical on differentiation

5.4 Integration and applications

### **Unit 06: Basic Linear Algebra**

[2 Theory+ 4Practical = 6Lectures]

6.1 Eigenvalues

6.2 Eigenvectors

6.3 Matrix representation

6.4 Matrix operations

6.5 Practical on Eigen value and Eigen vector

**Mode of Evaluation:** Written and practical examination.

#### **Books and references:**

- 1) An Introduction to SAGE Programming with Applications by Razvan A. Mezei, Springer.
- 2) [www.sagemath.org](http://www.sagemath.org)