

ADE/B.Ed. (Hons) Elementary

Syllabus

Mathematics

Semester 2

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Technical Support: Education Development Centre (EDC); Teachers College, Columbia University

Syllabus: General Mathematics

Subject: General Mathematics

Credit value: 3 credit hours

Prerequisite: SSC Mathematics

This course provides opportunities for prospective elementary teachers to strengthen their mathematical knowledge and skills and to gain confidence in their understanding of mathematics. An important outcome of this course is for prospective teachers to be able to teach mathematics successfully in the elementary grades.

Research-based knowledge about good math instruction provides a solid base of information for educators to use as they identify mathematics skills students need to develop, as well as teaching strategies and instructional approaches that best support the development of these skills. The course is designed based on what research tells us about good math instruction.

The overall organization of the course is divided into four units:

1. Number and Operations
2. Algebra and Algebraic Thinking
3. Geometry and Geometric Measurement
4. Information Handling

Each unit of study has a consistent design or organization and is meant to maximize time on learning for prospective teachers.

1. **Content:** Most one hour sessions will begin working on a math problem. Prospective teachers will engage in solving and discussing a math problem and sharing approaches and solutions. The content has been developed to so that prospective teachers will engage in mathematics *in depth* to help them connect concepts within and across the four units.
2. **Pedagogy:** In each lesson prospective teachers will actively engage in doing mathematics in order to experience approaches to teaching and learning math that they can use when they teach. They will recognize that there are often multiple ways of approaching a problem and in some instances more than one correct answer. The instructor will present questions that stimulate curiosity and encourage prospective teachers to investigate further by themselves or with their classmates.

The course will also examine how children learn and develop mathematical understanding and skills and how the way children think influences the teaching of mathematics in the primary, elementary, and middle grades.

3. **Assignments:** Students are expected to continue learning about math and the teaching of math after class. There will be assignments to stretch prospective teachers content knowledge and to learn more about teaching math. Assignments will take many forms including independently solving math problems and school based tasks.

In summary, the General Mathematics course is a comprehensive effort to build and deepen maths content knowledge, to learn and use high-quality instructional practices, and to study ways in which young students approach and learn mathematics.

Course outcomes:

Students will:

- Increase their mathematical content knowledge for Number and Operations, Algebra and Algebraic Thinking, Geometry and Geometric Measurement, and Information Handling for teaching in the primary, elementary, and middle grades
- Increase their confidence, competence, interest, and enthusiasm for mathematics by exploring and doing mathematics
- Deepen an understanding of how children learn mathematics
- Build a variety of instructional techniques with clear purposes
- Enhance their use of questioning techniques to elicit children's understanding
- Learn ways to engage students in mathematical thinking through interactive activities

Semester Outline

Unit 1: Numbers and Operations (5 weeks/15 hrs)

The prospective teacher will:

- Differentiate between various types of numbers in our number system
- Know various models for arithmetic operations (addition, subtraction, multiplication and division) with natural numbers, rational numbers, and integers
- Understand Base-10 place value as it relates to natural numbers and eventually to decimals
- Be able to describe the relationship among and between fractions, decimals, ratios, rates, proportions, and percentages

Week #	Themes	Sub themes
1	Numbers and Operations	<ul style="list-style-type: none"> • Counting • Models for Addition & Subtraction with natural numbers • Addition and Subtraction as inverse Operations • Word problems involving addition and subtraction
2	Place Value Numbers and Operations	<ul style="list-style-type: none"> • Working in the base-10 system • Models for Multiplication with natural numbers • Multiplication and Division as inverse operations • Models for Division with natural numbers • Nature of the remainder in division • Factors, Prime and Composite Numbers
3	Fractions and Decimals	<ul style="list-style-type: none"> • Models of fractions (sets, number line, area, volume) • Types of fractions (proper, improper and mixed-number) • Decimals as fractions linked to base-10 place value • Concept of GCF and LCM • Operations with fractions and decimals
4	Percent Ratios and Proportion Rates	<ul style="list-style-type: none"> • Percent as related to fractions and decimals • Ratio and Proportion • Rates
5	Integers	<ul style="list-style-type: none"> • Integers, Operations with integers • Venn Diagrams

Unit 2: Algebra (4 weeks/12 hrs)

The prospective teacher will be able to:

- Describe the connection between Arithmetic and Algebra
- Identify the repeating and/or increasing unit in a pattern and express that pattern as a rule
- Understand what variables are and when and how variables are used
- Express algebraic relationships using words, tables, graphs, and symbols
- Use order of operations to solve for unknowns in algebraic equations

Week #	Themes	Sub themes
1	Algebra as Generalized Arithmetic Patterns	<ul style="list-style-type: none">• Repeating patterns and growing patterns• Generalizing a pattern and finding a rule
2	Algebraic terminology, the concept of x as a variable, coordinate graphs, multiple representations, the concept of identity	<ul style="list-style-type: none">• Creating coordinate graphs• Continuous, discontinuous, and discrete graphs• Equivalent expressions
3	Linear functions Order of Operations	<ul style="list-style-type: none">• Interpreting tables, graphs and equations of linear functions• The concept of slope• Order of Operations
4	Square expressions and equations Symbol manipulation	<ul style="list-style-type: none">• Interpreting tables, graphs and equations of quadratic functions• Solving for x, the unknown

Unit 3: Geometry and Geometric Measurement (5 weeks/15 hrs)

The prospective teacher will:

- Understand undefined terms in geometry
- Identify and construct different types of angles.
- Identify characteristics and measurable attributes of 2-dimensional figures and 3-dimensional objects
- Calculate area, perimeter, surface area, and volume
- Understand square numbers, square roots, and the relationships involved in the Pythagorean Theorem

Week #	Themes	Sub themes
1	Polygons	<ul style="list-style-type: none">• Characteristics of Polygons with an emphasis on Triangles and Quadrilaterals,
2	Undefined terms in geometry Identification and construction of angles	<ul style="list-style-type: none">• Point, line, line segment, ray• Models of angles• Benchmark angles• Classifying angles by measurement
3	Geometric Measurement: Area and Perimeter of polygons	<ul style="list-style-type: none">• Perimeter and Area formulas
4	Geometric Measurement: Circumference and Area of Circles Surface Area of Cuboids and Cylinders	<ul style="list-style-type: none">• Circumference and Area formulas• Surface Area formulas

5	Volume of Cuboids and Cylinders Introduction to the Pythagorean Theorem	<ul style="list-style-type: none"> • Volume formulas • Squares, square numbers, square roots (surds) • The Pythagorean Theorem
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Unit 4: Information Handling (2 weeks/6 hrs)

The prospective teacher will:

- Recognize and construct various types graphs
- Determine which types of graphs best describe a given situation
- Analyze a graph and interpret its information
- Understand different measures of central tendency and determine which best describes a given situation

Week #	Themes	Sub themes
1	Graphic displays of information	<ul style="list-style-type: none"> • Collect & organise data via: tally marks, pictographs, line plot, bar graph, and line graphs (discrete and continuous) • Interpret the above graphic displays of data
2	Measures of dispersion and central tendency	<ul style="list-style-type: none"> • Range • Mean • Median • Mode

Course Grading Policy

A variety of assessments will be used to assign a final grade. It is recommended that course work be used to assign at least 50% of the final grade. Your instructor will tell you at the start of the course how your final grade will be determined and which pieces of course work will be assessed.

Suggested Resources:

These resources provide additional information about math education and the mathematical topics addressed during the course.

NCTM *Illuminations*: <http://illuminations.nctm.org/>

Maths Curriculum: <http://nzmaths.co.nz/>

N-Rich Maths site: <http://nrich.maths.org/public/>

How Students Learn: History, Mathematics, and Science in the Classroom

www.nap.edu/catalog.php?record_id=10126#toc Published by National Academies Press.

What does Good Mathematics Instruction Look Like?:

<http://www.naesp.org/resources/2/Principal/2007/S-Op51.pdf>

Mathematics for Elementary School Teachers, by Tom Basserear, published by Brooks Cole.

Elementary and Middle School Mathematics: Teaching Developmentally, by John A. Van de Walle, Karen Karp, and Jennifer Bay-Williams, published by Pearson Education.

Mathematics Explained for Primary Teachers, by Derek Haylock, published by SAGE Publications.