

Prepared by the Department of Mathematics
Date of Departmental Approval: December 4, 2017
Date approved by Curriculum and Programs: January 31, 2018

Effective: Fall 2018

1. Course Number: MAT120

Course Title: Mathematics for Elementary and Early Childhood Educators I

2. Description: This course is designed for students planning to teach Elementary and/or Early Childhood Education. Students develop an understanding of the mathematical content of numbers and operations at the deep level required for successful elementary school teaching in ways that are meaningful to pre-service elementary and early childhood educators. Topics include: critical thinking skills; sets and operations on sets; the whole number system and its operations; place value and arithmetic models; mental math; algorithms; pre-algebra; factors, divisibility, prime numbers, elementary number theory, and their applications; the integers and its operations; clock arithmetic; fractions and rational numbers; decimals and the real number system; ratios, rates, and proportions; and percents. (4 contact hours)

3. Student Learning Outcomes (instructional objectives, intellectual skills):

Upon successful completion of this course, students are able to do the following.

- Identify the principles behind problem solving and be able to apply a variety of problem solving strategies
- Identify and implement methods of mathematical reasoning
- Define, identify, and operate with sets
- Define, identify, and operate with the natural number and whole number sets.
- Recognize relationships among operations (e.g., addition and subtraction, addition and multiplication, multiplication and exponentiation)
- Identify and apply the arithmetic properties and the transitive properties of equality and inequality
- Apply the order of operations
- Apply the laws of exponents
- Analyze the structures and properties of the base-10 and other numeral systems, including numeration systems of ancient cultures
- Analyze and justify standard and nonstandard computational algorithms and mental math techniques (e.g., by application of the arithmetic properties, such as commutative, associative, distributive)
- Evaluate the validity of nonstandard or unfamiliar computational strategies
- Recognize decimal expansions
- Compare, sort, order, and round numbers
- Analyze procedures (e.g., rounding, regrouping) for estimation
- Determine the reasonableness of estimates
- Identify prime and composite numbers and their characteristics
- Find the prime factorization of a number and recognize its uses
- Demonstrate knowledge of the divisibility rules and why they work
- Find the least common multiple (LCM) and the greatest common factor (GCF) of a set of numbers
- Apply the LCM and GCF in real-world situations
- Define, identify, and operate with the set of integers
- Use number lines
- Interpret the concept of absolute value
- Define, identify, and operate with the set of rationals
- Recognize and elaborate upon the meaning and models of operations on real rational numbers
- Define, identify, and operate with decimal quantities
- Use scientific notation in the real world
- Define, identify, and operate with the set of irrationals

- Define, identify, and operate with proportional relationships
- Apply appropriate strategies (e.g., proportional thinking, ratios) to estimate quantities in real-world situations
- Define, identify, and operate with percents
- Identify subsets of real numbers and their characteristics
- Recognize and analyze various representations (e.g., graphic, pictorial, verbal) of number operations
- Analyze and convert among various representations of numbers (e.g., graphic, numerical, symbolic, verbal)
- Recognize equivalent representations of numbers (e.g., fractions, decimals, percents)
- Recognize both the meaning and models of integers, fractions, decimals, percents, and mixed numbers
- Express competency in applying them to the solution of word problems
- Solve problems using arithmetic operations with various representations of numbers

4. **Credit(s):** 3 credits

5. **Satisfies General Education Requirement:** No

6. **Prerequisites:** MAT035 (Algebra for Non-STEM) or MAT045 (Intermediate Algebra for STEM) or satisfactory basic skills assessment score and ECE100 (Introduction to Early Childhood Education) or EDU101 (Foundations in Education)

7. **Semester(s) Offered:** Fall, Spring, Summer

8. **Suggested General Guidelines for Evaluation:** Students will be assessed on their ability to correctly complete homework assignments, quizzes, and/or exams on the mathematical content described above. They will also be assessed on their ability to complete small projects which demonstrate their deep understanding of these mathematical concepts in ways that are meaningful to pre-service elementary teachers. Both theoretical and pedagogical research papers with respect to number theory and fractions will be assigned.

9. **General Topical Outline:** Please see the attached.

MAT120 Mathematics for Elementary and Early Childhood Teachers I

I. Critical Thinking Skills

- A. Introduction to Problem Solving
- B. Problem Solving Principles
- C. Problem Solving Strategies
- D. Algebra as a Problem Solving Strategy
- E. Additional Problem Solving Strategies
- F. Methods of Mathematical Reasoning

II. Sets and Whole Numbers

- A. Sets and Operations on Sets
- B. Sets, Counting, and the Whole Numbers
- C. Addition and Subtraction of Whole Numbers
- D. Multiplication and Division of Whole Numbers

III. Numeration and Computation

- A. Numeration Systems Past and Present
- B. Non-decimal Positional Systems
- C. Algorithms for Adding and Subtracting Whole Numbers
- D. Algorithms for Multiplying and Dividing Whole Numbers
- E. Mental Arithmetic and Estimation

IV. Number Theory

- A. Divisibility of Natural Numbers
- B. Tests for Divisibility
- C. Greatest Common Divisor (GCD) and the Least Common Multiple (LCM)
- D. Applications of Number Theory

V. Integers

- A. Representations of Integers
- B. Addition and Subtraction of Integers
- C. Multiplication and Division of Integers
- D. Clock Arithmetic

VI. Fractions and Rational Numbers

- A. Basic Concepts of Fractions and Rational Numbers
- B. Addition and Subtraction of Fractions
- C. Multiplication and Division of Fractions
- D. Rational Numbers and Their Properties

VII. Decimals, Real Numbers, and Proportional Reasoning

- A. Decimals and Real Numbers
- B. Computations with Decimals
- C. Proportional Reasoning
- D. Percent