Department of Mathematics   **Course No. MA 627**
Title of Course: Algebraic Reasoning   **New: Fall 2013**

I.   Catalog Description and Credit Hours of Course:

This course will focus on the content and complexities of teaching and assessing algebraic reasoning in grade 1-6 settings. Course content will include examination of representation and analysis of mathematical situations and structures. Attention will be given to patterns, functions, and the transition from arithmetic to algebra. (3)

II.   Co-requisite:
MA617 Internship in Algebraic Reasoning.

III.   Purposes and Objectives of the Course:
This course will focus on the content and complexities of teaching and assessing algebraic reasoning in grade 1-6 settings. Candidates will develop an expertise related to algebraic reasoning that will support teachers and enhance student learning. Candidates will also examine the learning trajectories children exhibit as they develop algebraic reasoning concepts and skills. Course content will include examination of representation and analysis of mathematical situations and structures. Attention will be given to patterns, functions, and the transition from arithmetic to algebra.

The learner will:
- Represent and justify general arithmetic claims, using a variety of representations, algebraic notation among them; understand different forms of argument and learn to devise deductive arguments and to refute claims as appropriate. In addition, recognize invalid arguments (e.g., examples-based justifications of general statements)
- Recognize commutativity, associativity, distributivity and use the elements of 1 and 0 as identify elements in the real number system; understand how these may be used in computations (e.g., make 10) to justify the correctness of standard and non-standard algorithms.
- Model problems (e.g., situations that could be modeled using constant, linear, exponential, and quadratic equations, or systems of equations), both mathematical and real-world, using algebraic representations. Use the process of substitution of particular numbers into expressions and apply to specific instances.
- Interpret and thoughtfully manipulate variables, algebraic expressions, and algebraic equations.
- Move fluidly and flexibly among verbal, graphical, tabular, and symbolic representations.
- Use the Common Core State Standards for Mathematics and the Learning Progressions to guide, implement, and assess the teaching and learning of algebraic reasoning.
- Develop in themselves the mathematical practices described in the Standards for Mathematical Practice from the Common Core State Standards for Mathematics in the context of algebraic reasoning.

IV.   Student Learning Outcomes:
  A. Student will apply properties of operations to variables
  B. Student will model relationships with algebraic expressions
  C. Student will identify and analyze learner created algorithms.

V. Expectations of Students:

    A. Regular class attendance.
    B. Participation in class activities.
    C. Read all assigned material.
    D. Adequate mastery of course content on examinations.

VI. Course Outline:

Topics	Class Hours
A. Overview of Operations and Algebraic Thinking and Expressions and Equations domains of the Common Core State Standards for Mathematics.	3
B. Common Core Learning Progressions for Operations and Algebraic Thinking and Expressions and Equations.	3
C. Properties of arithmetic operations as they relate to algebra.	3
D. Generalization and proof as related to developing a mathematical argument.	6
E. Defining quantities by a contextual situation	
1. Relationships	3
2. Using algebra to express relationship	3
F. Representing relationships	
1. Tables	3
2. Graphs	3
3. Verbal	3
4. Equations	3
5. Moving among relationships	3
G. Solving linear equations, systems of linear equations, and linear inequalities	3
H. Mathematical modeling	
1. Representing contextual situations	3
2. Making predictions using relations and functions	3
	45

VII. Resources:

Required:

NCTM Essential Understandings: "Developing Essential Understanding of Algebraic Thinking for Teaching Mathematics in Grades 3-5"

NCTM Essential Understandings: "Developing Essential Understanding of Mathematical Reasoning for Teaching Mathematics in Grades preK-8"

Thinking Mathematically: Integrating Arithmetic and Algebra in Elementary School, Carpenter, Heinemann

Long, C.T., De Temple, D.W., and Millman, R.S. (2012) *Mathematical Reasoning for Elementary Teachers*(6th ed), Pearson Education, Inc.

VIII. Basis of Student Evaluation:

- Written exams and quizzes   40%
- Assigned problem sets   15%
- Curriculum development project demonstrating course principles   40%
- Analysis and evaluation of existing curriculum and peer-developed lessons   5%

IX. Grading Scale
90% - 100% = A
80% - 89% = B
70% - 79% = C
0% - 69% =   F

The weight of the evaluation criteria may vary according to each instructor and will be communicated at the beginning of the course.

X.   Academic Policy Statement:
Students will be expected to abide by the University Policy for Academic Honesty regarding plagiarism and academic honesty. Refer to:
http://www6.semo.edu/judaffairs/code.html

XI.   Student with Disabilities Statement:
If a student has a special need addressed by the Americans with Disabilities Act (ADA) and requires materials in an alternative format, please notify the instructor at the beginning of the course. Reasonable efforts will be made to accommodate special needs.