Course Proposal: **New Course**

1. Course prefix and number: **MTE 548**

2. Effective Term/Year: **FALL 2013**

3. CIP CODE/10 digit program code: **13131100**

4. Short Course Title: **Quantitative Reasoning**

5. Enter course description exactly as it will appear in the general/graduate bulletin.

Elementary concepts of sets, numeration systems, number theory, and properties of the natural numbers, integers, rational, and real number systems with an emphasis on problem solving and critical thinking. Special attention will be given to implementation of number concepts into the elementary and middle school classrooms.

6. Prerequisites: **At least 6 hours of undergraduate mathematics or consent of instructor**

7. College: **College of Science and Mathematics**

8. Department Teaching Course: **Mathematics and Statistics**

9a. Instruction Type: **Lecture**

9b. Credit Hours:
Maximum: **3** Minimum: **3** Maximum Hours counted toward degree: **3**

10a. Instruction Type: **ns**

10b. Credit Hours:
Maximum: Minimum: Maximum Hours counted toward degree:

11. Maximum contact hours each week fall semester Lecture: **3** Lab: Other:

12. May this course be taken more than one time each semester: **No**

13. Grade Type: **Regular: A-F**

14. Will this course require additional library resources: **No**

15. Does this course replace a course on the current/previously listed inventory: **No**

16. If Yes list the prefix and number: If not applicable enter N/A: **N/A**

17. What is the primary reason you are proposing this course?

We are proposing a consolidation of existing graduate majors, School Mathematics Teaching: Middle Level and School Mathematics Teaching: Secondary Level, into a single major in School Mathematics Teaching with a 24 credit hour core and emphases in middle or secondary levels. The content of this course has been taught in the form of a special topics course in the graduate major for middle level teachers; we are proposing a permanent course number as a replacement.

18. Describe the place of the proposed course within your current curriculum. Will it be elective or required? Part of a major or a minor?

The content of this course is currently required for the existing middle level major and there is no change in the placement of the course as it will be required in the new consolidated major with emphasis on middle level.

19. How does the proposed course differ from similar courses being offered at Stephen F. Austin?

There is not comparable course offered at SFA.

20. Syllabus: Course Learning Goals

List course objectives; describe what students who complete the course will know or be able to do. **See attached syllabus.**

21. Syllabus: Course Outline
List the topics that the proposed course will cover and indicate the approximate proposed amount of time to be devoted to each, either by percent of course time or number of weeks. Please indicate which topics will be required in all sections of the course and which may vary.
See attached syllabus.

22. Syllabus: Proposed Textbook/Assigned Reading Materials for course
See attached syllabus.

23. Any Other Information

Dept. Chair _____ Date: _____

College Curriculum Chair _____ Date: _____

College Dean _____ Date: _____

Grad Dean/Univ Curr Chair _____ Date: _____

STEPHEN F. AUSTIN STATE UNIVERSITY

Department of Mathematics and Statistics

MTE 548 – Quantitative Reasoning
Course Syllabus

Course Description: Elementary concepts of sets, numeration systems, number theory, and properties of the natural numbers, integers, rational, and real number systems with an emphasis on problem solving and critical thinking. Special attention will be given to implementation of number concepts into the elementary and middle school classrooms.

Prerequisites: 6 hours of undergraduate mathematics or consent of instructor

Course Outline: **Approximate time spent**

- **Techniques of problem solving and estimation skills** **10%**
  The following topics will be threaded throughout the course in order to develop the habit of mind necessary in mathematics:
  - Introduce Polya's Problem Solving Process: Understand the Problem, Devise a Plan, Carry Out Plan, Look Back
  - Explore Basic Problem Solving Strategies
  - Explore Patterns in Language, Figures, Numbers, and Geometry: Sequences, Including Arithmetic and Geometric
  - Describe Patterns using Multiple Formats: Recursive & Closed Form Rules
  - Develop Estimation Skills with Mental Arithmetic

- **Sets and Logic: An Introduction** **20%**
  - Classify and Sort Objects According to Attributes
  - Introduce the Language of Logic Connectives: And, Or, Not, Implies
  - Use Venn Diagrams as Problem-Solving Tools
  - Introduce Set Terminology and Notation: Universal Set, Empty Set, Set Builder Notation, Element, Cardinality
  - Explore Set Relations, Operations, and Properties: Subset, Proper Subset, Equal, One-To-One Correspondence, Equivalent, Intersection, Union, Cross Product, Complement, Minus (Relative Complement), Disjoint, Commutative, Associative, Distributive
  - Introduce Functions as Sets

- **Whole Numbers and Numeration: Concepts and Algorithms** **15%**
  - Define the Set of Whole Numbers
  - Model Whole Number Operations using a Variety of Methods: Addition - Set Union, Number Line; Subtraction - Take Away, Missing Addend, Comparison, Number Line; Multiplication - Repeated Addition, Rectangular Array (Area), Cartesian Product, Number Line; Division - Repeated Subtraction, Missing Factor, Grouping, Sharing
  - Discover and Verify Properties of Operations: Binary Operation; Closed, Commutative, Associative, Distributive - Multiplication Over Addition, Identities, Multiplication By Zero; Division Algorithm
  - Explore Place Value Systems using Base Five Arithmetic
  - Develop and Apply Algorithms for Whole Number Operations
  - Develop Definition and Properties for Whole Number Exponents

- **Number Theory: An Introduction** **15%**
  - Define and Explore Primes and Composites
  - Explore Basic Divisibility Properties of Sums and Products
  - Explore Applications of the Fundamental Theorem of Arithmetic
  - Define the GCD and LCM and Use Algorithms for Finding Each
  - Explore Applications of the GCD and LCM

- **Integers: Concepts and Algorithms** **15%**
  - Model Integer Operations Using A Variety Of Methods Including Charged Field, Measurement, etc.
  - Investigate Extensions Of Whole Number Operations And Their Properties: Additive Inverse; Closed, Commutative, Associative, Distributive- Multiplication Over Addition, Identities, Additive Inverse, Multiplication By Zero
  - Define Absolute Value
  - Review Solution Techniques For Simple Linear Equations And Inequalities: Addition/Multiplication Properties Of Equality, Substitution Property, Cancellation Property
  - Revisit The Division Algorithm

- **Real Numbers: Concepts and Algorithms** **25%**
  - Investigate Practical Uses For Fractions
  - Explore Connections Between Fractions, Rational Numbers, Decimals, And Percent
  - Investigate Rational And Irrational Number Representations: Equivalent Fractions; Proper And Improper Fractions; Mixed Numbers; Decimals, Radicals, And Fractional Exponents - Square Root, Principal Square Root, n^{th} Root; Terminating And Repeating Decimals
  - Explore Concepts And Define/Demonstrate Properties Of Rational Number Operations To Include: Additive Inverse, Addition Property Of Equality, Multiplicative Identity, Multiplicative Inverse, Distributive Property Of Multiplication Over Addition, Multiplicative Property Of Equality, Multiplicative Property Of Zero
  - Investigate Order And Operations In Decimal Form
  - Investigate Irrational Number Order And Operations: Illustrate the Pythagorean Theorem
  - Define and Demonstrate Properties Of Real Numbers: Closure, Commutative, Associative, Distributive, Identity, Inverse, Density
  - Develop Proportional Thinking to Include Ratio and Proportion, Properties of Proportions, Fundamental Law of Fractions

Student Learning Outcomes (SLO): At the end of MTE 548, the successful student will be able to:

1. Solve a variety of problems using multiple problem-solving techniques. [PLO 1, 2, 3, 4, 5]
2. Demonstrate understanding of core concepts underlying standard and non-standard algorithmic procedures for performing operations on subsets of real numbers. [PLO 1, 2, 3, 4, 5]
3. Communicate his/her knowledge effectively in multiple formats – verbally, concretely, and in writing. [PLO 1, 2, 3, 4, 5, 6]
4. Define, identify, and use the fundamental properties of real number operations. [PLO 1, 2, 3, 4, 5]
5. Provide logical justification of mathematical thinking. [PLO 1, 3, 4, 5]
6. Use mathematical language and notation appropriately to communicate ideas. [PLO 1, 3, 4, 5, 6]
7. Make appropriate connections from MTE 550 to the elementary and middle level mathematics classroom. [PLO: 1, 2, 3, 4, 5, 6]

Program Learning Outcomes (PLO): Students graduating from SFASU with an M.S. degree and a major in school mathematics teaching will demonstrate:

1. Conceptual understanding and procedural fluency necessary for teaching the core areas of school mathematics (number/operation (N&O), patterns/algebra (P&A), geometry/measurement (G&M), and probability/statistics (P&S)). [*Concepts & Skills*]
2. Competences in using various mathematical tools (including technology) to formulate, represent, and solve problems. (N&O tools, P&A tools, G&M tools, and P&S tools applied to basic and multi-step computational and application problems) [*Problem Solving*]
3. The ability to use mathematical reasoning to develop conjectures, design sound arguments, and analyze student thinking. (pattern recognition/conjecture development, examples/non-examples, deductive/inductive reasoning, argument analysis) [*Critical Thinking*]
4. An understanding of the development and connectedness of mathematical ideas – historically, between content areas, and across grade levels. [*Connections*]
5. Effective communication of mathematical ideas in oral, visual, and written forms. [*Communication*]
6. Leadership skills in facilitating collaboration, mentoring teachers, making appropriate instructional decisions, and delivering professional development. [*Leadership*]

Date of document: 11/01/2012

Course Proposal: **New Course**

1. Course prefix and number: **MTE 555**

2. Effective Term/Year: **FALL 2013**

3. CIP CODE/10 digit program code: **13131100 No Change**

4. Short Course Title: **An Overview of Trigonometry**

5. Enter course description exactly as it will appear in the general/graduate bulletin.

Trigonometric functions of angles, degree and radian measure, fundamental identities; common trigonometric formulas, solution of triangles; polar coordinates; inverse trigonometric functions and complex numbers. Special attention will be given to the historical development of trigonometry and to the implementation of trigonometric concepts into the middle and high school curricula.

6. Prerequisites: **MTE 554 or equivalent**

7. College: **College of Science and Mathematics**

8. Department Teaching Course: **Mathematics and Statistics**

9a. Instruction Type: **Lecture**

9b. Credit Hours:
Maximum: **3** Minimum: **3** Maximum Hours counted toward degree: **3**

10a. Instruction Type: **ns**

10b. Credit Hours:
Maximum: Minimum: Maximum Hours counted toward degree:

11. Maximum contact hours each week fall semester Lecture: **3** Lab: Other:

12. May this course be taken more than one time each semester: **No**

13. Grade Type: **Regular: A-F**

14. Will this course require additional library resources: **No**

15. Does this course replace a course on the current/previously listed inventory: **No**

16. If Yes list the prefix and number: If not applicable enter N/A: **N/A**

17. What is the primary reason you are proposing this course?

We are proposing a consolidation of existing graduate majors, School Mathematics Teaching: Middle Level and School Mathematics Teaching: Secondary Level, into a single major in School Mathematics Teaching with a 24 credit hour core and emphases in middle or secondary levels. The content of this course has been taught in the form of a special topics course in the graduate major for middle level teachers; we are proposing a permanent course number as a replacement.

18. Describe the place of the proposed course within your current curriculum. Will it be elective or required? Part of a major or a minor?

The content of this course is currently required for the existing middle and secondary level majors and there is no change in the placement of the course as it will be required in the new consolidated major with either emphasis.

19. How does the proposed course differ from similar courses being offered at Stephen F. Austin?

There is not comparable course offered at SFA.

20. Syllabus: Course Learning Goals

List course objectives; describe what students who complete the course will know or be able to do. **See attached syllabus.**

21. Syllabus: Course Outline
List the topics that the proposed course will cover and indicate the approximate proposed amount of time to be devoted to each, either by percent of course time or number of weeks. Please indicate which topics will be required in all sections of the course and which may vary.
See attached syllabus.

22. Syllabus: Proposed Textbook/Assigned Reading Materials for course
See attached syllabus.

23. Any Other Information

Dept. Chair _____ Date: _____

College Curriculum Chair _____ Date: _____

College Dean _____ Date: _____

Grad Dean/Univ Curr Chair _____ Date: _____

MTE 555 – An Overview of Trigonometry
Course Syllabus

Course Description: Trigonometric functions of angles, degree and radian measure, fundamental identities; common trigonometric formulas, solution of triangles; polar coordinates; inverse trigonometric functions and complex numbers. Special attention will be given to the historical development of trigonometry and to the implementation of trigonometric concepts into the middle and high school curricula.

Prerequisites: MTE 554 or equivalent

Course outline: Approximate time spent

- Angles and definitions of trigonometric functions 15%
  - Angles
    - Degree measure of angles
    - Reference angles
    - Radian measure of angles
    - Arc length, angular velocity, linear velocity
  - Trigonometric functions
    - Definition using the unit circle
    - Reciprocal, ratio, and Pythagorean identities
    - Definition using ratios of sides of right triangles
    - Evaluating exact values for special angles
- Graphs of trigonometric functions 15%
  - Basic graphs of the trigonometric functions
  - Modified graphs of the trigonometric functions
    - Amplitude
    - Period
    - Vertical translation
    - Phase shift
- Inverse Trigonometric Functions and Solving Equations 15%
  - Definitions and graphs of inverse trigonometric functions
  - Calculations with inverse trigonometric functions
  - Solving trigonometric equations
    - Using factoring, identities, and quadratic formula
    - Arguments with multiple angles
    - Using inverse functions to approximate solutions
- Identities 15%
  - Logic and techniques for proving identities
  - Calculations with identities
  - Sum and difference identities
  - Even, odd, and cofunction identities
  - Double and half-angle identities
  - Product-to-sum and sum-to-product identities

- Solving Triangles 15%
    - Accuracy and significant digits
    - Solving right triangles
    - Law of Cosines
    - Law of Sines
    - Ambiguous case (SSA)
    - Applications
        - Navigation
        - Surveying
        - Angles of depression/elevation
        - Areas of triangles
- Vectors, Complex Numbers, and Polar Coordinates 10%
    - Vectors
        - Definitions
        - Algebraic representations and resolving vectors
        - Resultant vector
        - Angle between vectors
        - Dot product and orthogonality
        - Applications
            - Forces
            - Air speed/ground speed
            - Work
    - Complex number system
        - Definitions
        - Arithmetic and simplification of complex numbers
        - Trigonometric form
        - Products and quotients in trigonometric form
        - De Moivre's Theorem
        - nth root theorem
    - Polar coordinate system
        - Definitions
        - Various representations for points using polar
        - Conversion between polar and rectangular coordinates
        - Graphs of polar equations
            - Conversion between polar and rectangular
            - Special polar graphs
- Connections to the middle and secondary classrooms 15%

Student Learning Outcomes (SLO): At the end of this course, successful students will be able to:

- State and use the unit circle and ratio definitions of the six trigonometric functions. [PLO 1, 2, 3, 4, 5]
- Recall and use exact values of the trigonometric functions at integer multiples of $\pi/4$ and $\pi/6$ in various contexts, especially in graphing trigonometric functions. [PLO 1, 2, 3, 4, 5]
- Graph the trigonometric functions, and graph transformations of trigonometric functions by recognizing amplitude, changes in period, vertical translations, and phase shifts. [PLO 1, 2, 3, 4, 5]

- Use appropriate trigonometric identities in solving equations involving trigonometric functions and in calculating trigonometric function values. [PLO 1, 2, 3, 4, 5]
- Use logical reasoning and known trigonometric identities to verify that an equation is a trigonometric identity. [PLO 1, 2, 3, 4, 5]
- Use inverse trigonometric functions in applications and in solving equations. [PLO 1, 2, 3, 4, 5]
- Determine unknown measures of sides and/or angles of triangles for which some specific measures are given. [PLO 1, 2, 3, 4, 5]
- Solve application problems using tools such as vectors, right triangle trigonometry, the Law of Sines, and the Law of Cosines. [PLO 1, 2, 3, 4, 5]
- Perform arithmetical operations with complex numbers and find powers and roots of complex numbers in trigonometric form. [PLO 1, 2, 3, 4, 5]
- Use the polar coordinate system, relate it to the rectangular coordinate system, and graph equations using polar coordinates. [PLO 1, 2, 3, 4, 5]
- Make connections between the concepts of this course and the middle and high school curricula. [PLO 1, 2, 3, 4, 5, 6]

Program Learning Outcomes (PLO): Students graduating from SFASU with an M.S. degree and a major in school mathematics teaching will demonstrate:

1. Conceptual understanding and procedural fluency necessary for teaching the core areas of school mathematics (number/operation (N&O), patterns/algebra (P&A), geometry/measurement (G&M), and probability/statistics (P&S)). [*Concepts & Skills*]
2. Competences in using various mathematical tools (including technology) to formulate, represent, and solve problems. (N&O tools, P&A tools, G&M tools, and P&S tools applied to basic and multi-step computational and application problems) [*Problem Solving*]
3. The ability to use mathematical reasoning to develop conjectures, design sound arguments, and analyze student thinking. (pattern recognition/conjecture development, examples/non-examples, deductive/inductive reasoning, argument analysis) [*Critical Thinking*]
4. An understanding of the development and connectedness of mathematical ideas – historically, between content areas, and across grade levels. [*Connections*]
5. Effective communication of mathematical ideas in oral, visual, and written forms. [*Communication*]
6. Leadership skills in facilitating collaboration, mentoring teachers, making appropriate instructional decisions, and delivering professional development. [*Leadership*]

Date of document: 11/01/2012