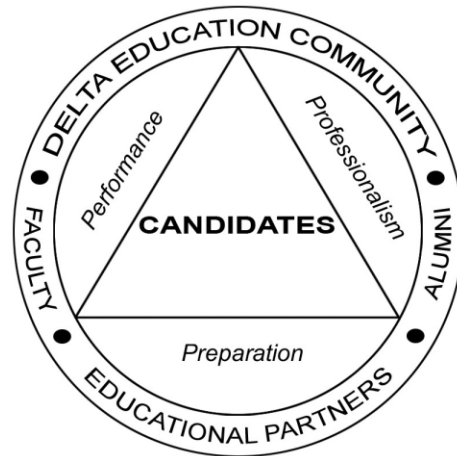**I.** **Course Designation: MAT 331**
  Course Title: MATHEMATICS THROUGH PROBLEM SOLVING
  Course Description: Professionalized subject matter of elementary school mathematics. Prerequisites: MAT 131 with a C or better. 3

II. **Conceptual Framework:**

DELTA P³ MODEL

Vision: The Delta State University College of Education promotes a vibrant educational community committed to preparing capable and confident candidates who can positively affect learning outcomes of students in the P-12 school setting. Appropriately illustrated by the Delta triangle, the model reflects candidate development through the triad of preparation, performance and professionalism, supported by the greater Delta educational community (faculty, educational partners, and alumni).

Guiding Principles:
  1. **Education is a lifelong endeavor,** requiring an ever-expanding content knowledge base, a repertoire of skills, and a broad experience base. (GP1)
  2. **Education is interactive and reflective,** a process that is accomplished through assessment and reflection of a collaborative nature. (GP2)
  3. **Education is culturally contextualized**, requiring both an understanding and appreciation of the diversity of all individuals within the learning community. (GP3)
  4. **Education is dynamic,** with change being driven by assessment data and the needs of all segments of the educational community. (GP4)
  5. **Education is enhanced by technology,** infused throughout programs and services. (GP5)

III. **General Course Goals/Objectives:** This course is designed to provide the candidate, who has knowledge of the content of elementary school mathematics, with strategies for teaching mathematics. The goals and principles of this course are aligned with those of the National Council of Teachers of Mathematics (NCTM). The *Curriculum and Evaluation Standards for School Mathematics* articulate five general goals for all students: (1) that they learn to value mathematics, (2) that they become confident in their ability to do mathematics, (3) that they become mathematical problem solvers, (4) that they learn to communicate mathematically, and (5) that they learn to reason mathematically (NCTM, 1989). The *Principles and Standards for School Mathematics* identify the following six overarching themes for mathematics education: (1) Equity: excellence in mathematics education requires equity—high expectations and strong support for all students; (2) Curriculum: a curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and is well articulated across the grades; (3) Teaching: effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well; (4) Learning: students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge; (5) Assessment: assessment should support the learning of important mathematics and furnish useful information to both teachers and student; (6) Technology: technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning (NCTM, 2000). In addition to the aforementioned goals and principle, the goals of this course are for candidates to develop proficiency in modeling mathematical concepts using a variety of concrete materials, to apply critical judgment to resources for the purpose of investigating materials and strategies, to compare traditional approaches to teaching and learning mathematics to current research on how children learn, and to use technology appropriately in teaching and learning mathematics for elementary school.

IV.   Subject Matter/Content:

Course Materials:

1. **Wiley PLUS:** This software contains an electronic version of the textbook used in this course, supplemental resources, all independent assignments, and all assessments. You can purchase the software at: http://wileyplus.com

2. **Textbook:** If you do not like reading electronic versions of textbooks, you can purchase the physical textbook. Musser, G.L, Peterson, B.E., Burger, W.F. (2014). *Mathematics for Elementary Teachers: A Contemporary Approach, 10th Edition,* Wiley. eText: ISBN-13 9781118800386, Print: ISBN-13 978-1-118-45744-3

3. **The Common Core State Standards** will be a guide to all that is covered in this class. They may be found on line at: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf

4. **Instructional Resources**: Ewing 222, IRC, Internet, and library.

5. **Notebook and pencil**

Content Topics: This course will cover the following topics: number theory, fractions numbers and operations with fractions numbers, decimal numbers and operations on decimal numbers, ratios and integers and operations with integers.

Technology Statement: Candidates will use a variety of technology resources in this course. These include, but are not limited to Virtual Manipulative Tools, Educational Application Tools, Canvas Learning Management System, the Internet, and Microsoft Excel.

Diversity Proficiencies Expected of all Candidates: Candidates will:

1. Develop the capacity to teach in diverse settings with students and colleagues of varying backgrounds, ethnicities, capabilities, and beliefs (CF 1, 3; DRS 3)
2. Identify contextual factors that may influence student learning and act upon those factors in planning curriculum and instruction. (CF 2, 3, 4; DRS 2)
3. Establish classroom and school climate that reflects the belief that all students have the ability to learn. (CF 2, 3, 4; DRS 1, 2, 4)
4. Differentiate instruction and experiences based on contextual factors and the diverse needs of learners. (CF 2, 3, 4, 5; DRS 1, 2, 4)
5. Use appropriate assessment strategies to serve the diverse needs of learners. (CF 3, 4; DRS 1,2)

*CF = Delta P^3 Model; DRS = Dispositions Rating Scale

Specific Course Objectives:

1. The candidate should know and understand what are prime and composite numbers.
2. The candidate should know and be able to use the Sieve of Eratosthenes.
3. The candidate should be able to use the Fundamental Theorem of Arithmetic.
4. The candidate should be able to use the definition of Divides.
5. The candidate should be able to use the words Factors, Multiples and Divides correctly.
6. The candidate should be able to use the test for divisibility for 2,3,4,5,6,8,9 and 10.
7. The candidate should be able to use the Prime Factor Test.
8. The candidate should be able to use the properties of divides:
9. If a|m and a|n then a| (m+n)
10. If a|m and a|n then a| (m-n) where m>n
11. If a|m then a| km
12. The candidate will be able to determine all of the divisors of the given number.
13. The candidate will be able to determine all of the multiples of a give number.
14. The candidate should be able to explain the concept of a fraction.
15. The candidate should be able to explain the concept of Equivalent Fractions.
16. The candidate should be able to draw and use Fraction Strips.
17. The candidate should be able to determine if two fractions are equal.
18. The candidate should be able to express fractions in simplest forms.
19. The candidate shall not use the expressions lowest terms.
20. The candidate should know how to write improper fractions as mixed numbers and vice versa.
21. The candidate should be able to add fractions with Common Denominators.
22. The candidate should be able to add fractions with unlike Denominators.
23. The candidate should be able to explain the reason for finding common denominators.
24. The candidate should be able to use the Commutative Property of Fraction Addition.
25. The candidate should be able to use the Associative Property of Fraction Addition.
26. The candidate should be able to subtract fractions with like Denominators.
27. The candidate should be able to subtract fractions with unlike Denominators.
28. The candidate should be able to multiply fractions.
29. The candidate should be able to draw and explain illustrations for multiplication. (Fig. 6.19 and 6.20)
30. The candidate should be able to use and illustrate the following: Closure Property for Fraction Multiplication, Commutative Property for Fraction Multiplication, Associative Property for Fraction Multiplication, Multiplicative Identity Property for Fraction Multiplication, and Multiplicative Inverse Property for Fraction Multiplication.
31. The candidate should be able to use, draw, and explain the Distributive Property of Multiplication over Addition for Fractions.
32. The candidate should be able to divide fractions with like and unlike denominators.
33. The candidate should be able to draw and explain illustrations for the division of fractions.
34. The candidate should be able to write decimal numbers in expanded form.
35. The candidate should be able to use a hundred squares to represent a decimal number.

36. The candidate should be able to multiply or divide a decimal number by a power of ten.
37. The candidate should be able to know which fractions terminate.
38. The candidate should be able to add and subtract decimal numbers.
39. The candidate should be able to multiply decimals using the standard algorithm.
40. The candidate should be able to multiply decimals using the lattice algorithm.
41. The candidate should be able to divide decimal numbers.
42. The candidate should be able to adjust by powers of ten the factors in a multiplication problem so that the product remains the same.
43. The candidate should be able to adjust by powers of ten the dividends and division in a division problem such that the quotient remains the same.
44. The candidate should be able to convert fraction numbers to decimal numbers.
45. The candidate should be able to convert decimal numbers to fraction numbers.
46. The candidate should be able to use scientific notation.
47. The candidate should be able to write ratios using the colon notion, and fraction notation.
48. The candidate should be able to determine if two ratios are equal.
49. The candidate should be able to define part-to-part, part-to-whole, and whole-to-part ratios.
50. The candidate should be able to define the extremes and means of two ratios.
51. The candidate should be able to define a proportion.
52. The candidate should be able to use the ideas of scaling up and scaling down.
53. The candidate should be able to define percent.
54. The candidate should be able to draw and use the grid approach to solving percent problems.
55. The candidate should be able to use the proportion approach to solving percent problems.
56. The candidate should be able to use the equation approach to solving percent problems.
57. The candidate should be able to define the set of Integers.
58. The candidate should be able to define a zero pair.
59. The candidate should be able to use two color chips to represent any integer amount.
60. The candidate should be able to apply, explain and use the following properties for Integer Addition: Closure, Commutative Property, Associative Property, Identity, Additive Inverse
61. The candidate should be able to state the definition of addition for Integers.
62. The candidate should be able to state the definition of subtraction for Integers.
63. The candidate should be able to use all of the approaches for subtraction of integers: Take – Away, Adding-the-opposite, Missing addend
64. The candidate should be able to multiply and divide integers.
65. The candidate should be able to apply, explain and use the following properties for Integer Multiplication: Closure, Commutative, Associative, Identity, and the Distributive Property of Multiplication over Addition for Integers.
66. The candidate should be able to apply and explain the multiplicative 'cancellation' Property.
67. The candidate should be able to apply and explain Zero Division Property.
68. The candidate should be able to state the definition of Division of Integers.
69. The candidate should be able to apply and explain the Properties of Ordering Integers.
70. The candidate should be able to critique the relevance, customization, feedback thinking skills, usability, engagement, and sharing of educational application tools.
71. The candidate should be able to compose word problems using the context of math trade books that are relevant to the content of the course.

V. Major Course Activities: Research shows that people learn best from concrete experience, interacting with the content and with other learners, engaging in challenging tasks, being held accountable for their work, and receiving frequent feedback on their progress. The following course activities have been designed based on these principles:

1. **Readings & Individual Assignments** – Outside of class students will be responsible for individually completing reading assignments and application assignments from the course textbook. Additionally, students will also be required to complete a math literacy assignment and an app review assignment. These assignments will prepare students for the Readiness Assurance Tests, classroom application tasks, individual assignments, and cumulative assessments.
2. **Readiness Assurance Tests (RATs):** Each of the 4 instructional sequences will _begin_ with a multiple-choice RAT (with 10 items and 5 possible responses per item) _based on the assigned readings_. You will actually take each RAT twice, once on your own and once as a team. You will use instant feedback forms to take the team RAT which will provide your team with the opportunity to earn partial credit (1st response = 10 pts., 2nd response = 5 pts., 3rd response = 2 points, 4th or 5th response = 0 points). Your team will also be given the opportunity to write an evidence-based appeal after tests.
3. **Mini-Lecture –** After each RAT I will provide the class with direct instruction aimed at addressing overarching themes, summary reflections, and un-resolved questions. There will also be brief demonstrations of how to use tools.
4. **Application Tasks:** After mini-lectures you will spend the majority of class working on application tasks. You will be expected to interact with your team members during application tasks. This interaction should include checking strategies, representations, and solutions with your team members. Students will receive credit for their participation in application tasks. The application tasks will also prepare you for your individual assignments and cumulative assessments. Students will also evaluate their team members' performance.
5. **Cumulative Assessments:** There will be a cumulative assessment at the end of each instructional sequence and a final cumulative assessment at the end of the course.

Important Course Dates:

Date	Topics Addressed	Assignments
	Instructional Sequence One: *Number Theory* **Weeks 1-4**	

Weeks 1 – 4
 (Monday, January 12th – Sunday, February 8th)
	◊ Define and perform computations using prime and composite numbers.
	 ◊ Know and be able to use the Sieve of Eratosthenes.
	 ◊ Use the case the Fundamental Theorem of Arithmetic.
	 ◊ Use the definition of Divides.
	 ◊ Use the words Factors, Multiples and Divides correctly.
	 ◊ Use the test for divisibility for 2,3,4,5,6,8,9 and 10.
	 ◊ Use the Prime Factor Test.
	 ◊ Use the properties of divides: If a|m and a|n then a| (m+n); If a|m and a|n then a| (m-n) where m>n; and If a|m then a| km.
	 ◊ Write an expression that can be used to find the divisors of the given number.
	 ◊ Write an expression that can be used to find the multiples of a give number.
		◊ Read Chapter 5
		 ◊ Readiness Assurance Test (January 15, 2015)
		
		 ◊ Independent Assignments:
		    o 5.1 due: <u>1/25/15</u>
		    o 5.2 due: <u>2/1/15</u>
		
		 ◊ TEST ONE: <u>2/5/15</u>

	Instructional Sequence Two: *Fractions* **Weeks 5-7**	

Week 5-7
 (Monday, February 9th – Sunday, March 1st)
	◊ Explain the concept of a fraction.
	 ◊ Describe and calculate equivalent fractions.
	 ◊ Draw and use Fraction Strips.
	 ◊ Express fractions in simplest forms.
	 ◊ Write improper fractions as mixed numbers and vice versa.
	 ◊ Add, subtract, multiply, and divide fractions with both common denominators and unlike denominators.
	 ◊ Explain the reason for finding common denominators.
	 ◊ Use the Commutative and Associative Properties of fraction addition and multiplication.
	 ◊ Draw and explain illustrations for addition, subtraction, multiplication, and division.
	 ◊ Use and illustrate the following: Closure Property for Fraction Multiplication, Commutative Property for Fraction Multiplication, Associative Property for Fraction Multiplication, Multiplicative Identity Property for Fraction Multiplication, Multiplicative Inverse Property for Fraction Multiplication.
	 ◊ Use, draw, and explain the Distributive Property of Multiplication over Addition for Fractions.
		◊ Read Chapter 6
		 ◊ Readiness Assurance Test (February 10, 2015)
		 ◊ Independent Assignments:
		    o 6.1 Due: <u>2/15/15</u>
		
		    o 6.2 due: <u>2/20/15</u>
		
		    o 6.3 due: <u>2/24/15</u>
		
		 ◊ TEST TWO: <u>2/26/15</u>

	Instructional Sequence Three: *Decimals, Ratio, Proportion, and Percent* **Weeks 8-11**	

Weeks 8-11
 (Monday, March 2nd – Sunday, April 5th)
	◊ Write decimal numbers in expanded form.
	 ◊ Use a hundred squares to represent a decimal number.
	 ◊ Multiply or divide a decimal number by a power of ten.
	 ◊ Know which fractions terminate.
	 ◊ Add, subtract, multiply, and divide decimal numbers using standard and intermediate algorithms.
	 ◊ Adjust by powers of ten the factors in a multiplication problem and the dividends and divisor in a division problem so that the product remains the same.
	 ◊ Convert fraction numbers to decimal numbers and vice versa.
	 ◊ Use scientific notation.
	 ◊ Write ratios using the colon notion, and fraction notation.
	 ◊ Determine if two ratios are equal.
	 ◊ Define part-to-part, part-to-whole, and whole-to-part ratios.
	 ◊ Define the extremes and means of two ratios.
		◊ Read Chapter 7
		 ◊ Readiness Assurance Test (March 3, 2015)
		 ◊ Independent Assignments:
		    o 7.1 Due: <u>3/15/15</u>
		
		    o 7.2 due: <u>3/22/15</u>
		
		    o 7.3 due: <u>3/25/15</u>
		
		    o 7.4 due: <u>3/31/15</u>

	◊ The candidate should be able to define a proportion. ◊ Use the ideas of scaling up and scaling down. ◊ Define and compute percent. ◊ Draw and use the grid approach to solving percent problems. ◊ Use the proportion approach to solving percent problems. ◊ Use the equation approach to solving percent problems.	◊ Math Literacy assignment due: 4/2/15 ◊ TEST THREE: 4/2/15
Instructional Sequence Four: *Integers* **Weeks 12-14**		

Weeks 12-14
(Monday, April 6th – Sunday, April 26th)
	◊ Define the set of Integers.
	◊ Define a zero pair.
	◊ Use two color chips to represent any integer amount.
	◊ Apply, explain and use the following properties for integer addition: Closure, Commutative Property, Associative Property, Identity, and Additive Inverse.
	◊ State the definitions of addition, subtraction, multiplication, and division for Integers.
	◊ Use all of the approaches for subtraction of integers: Take – Away, Adding-the-opposite, and Missing addend.
	◊ Apply, explain, and use the following properties for Integer Multiplication: Closure, Commutative, Associative, Identity, and the Distributive Property of Multiplication over Addition for Integers.
	◊ Apply and explain the multiplicative 'cancellation' Property, Zero Division Property, and the Properties of Ordering Integers.
	◊ State the definition of Division of Integers.
		◊ Read Chapter 8
		◊ Readiness Assurance Test (April 7, 2015)
		◊ Independent Assignments:
		
		   o 8.1 due: 4/12/15
		
		   o 8.3 due: 4/28/15
		
		◊ App Review assignment due: 4/30/2015
		
		◊ TEST FOUR: 4/30/15

Week 15 Monday, April 27th – Friday, May 1st Review Week		
Week 16 Thursday, May 7th at 3 PM (for on campus section, TBD for Hinds 2 + 2 class) Final Examination		

VI. How Grades Will Be Earned:
 (A=90-100; B=80-89; C= 70-79; D=65-69; F=Below 65)
- 10% Readiness Assurance Tests (10% individual and 10% team; 3 RAPs)
- 10% Unit Tests (4 @ the end of each unit)
- 5% Team Member Performance Evaluation (Peer graded @ End of semester) 15% Team Tasks (14 weekly grades)
- 20% Team Tasks (14 weekly grades)
- 30% Independent Assignments **(minimum acceptable grade = C, Full letter grade reduction per day late)**
- 25% Final Examination

Requirement: Passing a rational numbers examination. Every student must take and pass a rational numbers test with no less than an 80% by the drop date for the current semester. Each student may take the examination at most three times during the semester. If a student does not pass the examination on the third attempt or by the last day of March or October, depending on the semester within which the student is taking the course, will receive an "F" in the course. Your first examination will be in class; whereas, the second two examinations, if needed, will be taken out of class at a time agreed upon by both the student and instructor.

Managing your life and this course: With the exception of the Independent Assignments, which will receive a 25%, 50%, and 100% reduction if they are up to 7 days, 14 days, and more than 14 days late, respectively, all other missed assignments will receive no credit. As many of the assignments in the course are team-based and completed in class, it is impossible to schedule make-up opportunities for missed assignments. Since there will be occasions in your life when missing a class meeting or missing a deadline for an assignment is simply unavoidable this course has a couple built-in safety valves. These are your tools to use in managing your life, please manage these carefully and be careful not to waste your safety valves early in the semester, because you may need them later in the semester:

Safety Valve One: Out of your 4 RAT grades the lowest 1 will be dropped (individual and team component)
Safety Valve Two: Out of your 4 Unit Test grades the lowest 1 will be replaced with your final exam grade (if it is higher)

Safety Valve Three: Out of the 14 weekly team task grades the lowest 2 will be dropped
Safety Value Four: Out of the 11 Independent Assignments 1 will be dropped.

VII. General Course Information:
Instructor: Liza Cope, Ph.D.
email: lcope@deltastate.edu
Office: Broom Hall 282

Office Hours:

Monday	Wednesday	Friday
8:00-11:30	8:00-11:30	8:00-11:30

Library: Requirements for courses include activities, projects, and/or papers where use of the University library is essential. Library hours are posted on the university website. The Instructional Resource Center in the library houses important materials useful specifically for education majors. Library resources are also available online. DSU students may secure access information by visiting the DSU Roberts-LaForge Library.

Class Attendance: Prompt and regular attendance is necessary for success in this course. Any student that exceeds 2 absences without verifiable excuses will receive a lowered participation grade. A student is allowed a maximum of 4 absences. Any person exceeding this number will receive a semester grade of "F."

Lateness-Tardiness Policy: If you need to arrive late or leave early and thereby miss part or all of an in-class assignment, you will receive no credit for the assignment, neither for individual work nor for the work of your team in your absence.

Course Deadlines: Failure to meet deadlines will result in a grade penalty on all assignments in this course. All assignment deadlines are indicated on the syllabus and will be announced in class. Failure to submit and acceptable portfolio will result in failure of this course. The final course shell will be due on the day of the Final Examination.

Examinations: Students are expected to take tests and examinations at the scheduled times. Should a conflict arise, the student should contact the instructor prior to the date of the test to make arrangements for taking the test or exam. The student will have three class days to make up any missed test after returning to school.

Cheating and Plagiarism: Cheating and plagiarism will not be tolerated. University policy will be followed, according to current catalog issues, and procedures specific to the Division will be enforced consistently across programs. These procedures will be disseminated and explained at the beginning of the semester.

Accountability for Individual Work: Unless otherwise directed, all papers and assignments are to represent the individual student's efforts. Students submitting a personal assignment that represents the collaborative works of others or the work of another individual will not be given credit for the assignment. If the offense constitutes cheating or plagiarism, university policy will be followed.

Bibliography: Appropriate sections of secondary mathematics textbooks, portions of *Principles and Standards for School Mathematics, Common Core State Standards*, and other books used throughout the semester. Appropriate articles form current periodicals such as *Mathematics Teacher* will be used throughout the semester. Resources: Ewing 222, IRC, Internet, and Roberts-LaForge Library.

VIII. Disabilities Statement and Policy:
It is the responsibility of students who have professionally diagnosed disabilities to notify the instructor so that necessary and/or appropriate modifications can be made to meet any special learning needs. Students are also directed to contact the Disability Director for the University who will coordinate the accommodations process.