Delta State University
Division of Teacher Education
Course Syllabus
Spring 2015
MAT 131

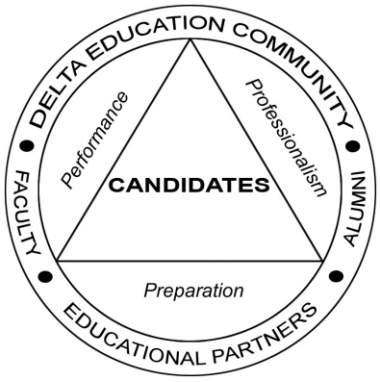
I. Course Designation: MAT 131

Course Title: Number Systems of Arithmetic

Course Description: MAT 131. NUMBER SYSTEMS OF ARITHMETIC. Structure and properties of the number systems of arithmetic. Primarily for prospective or in-service teacher. Prerequisites: MAT 103 or 104 with a C or better. 3

II. Conceptual Framework:

DELTA P^3 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/Objecties: At the end of this course the candidate should be able to solve problems using Polya's four-step procedure, recognize patterns in problems, and articulate their reasoning, strategies, and multiple representations of the solution. With respect to number systems, the candidate will develop a conceptual understanding of various numeration systems and the operations on whole numbers. The candidate will further investigate the nature of numbers and sets. Moreover, candidates will investigate prime and composite numbers and the Fundamental Theorem of Arithmetic. Candidates will use a variety of concrete and virtual interactive modeling tools to aid in their problem solving.

IV. Subject Matter/Content:

Course Materials:

1. **WileyPLUS:** 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. (2011). *Mathematics for Elementary Teachers: A Contemporary Approach, 9th Edition,* Wiley. ISBN: 9781118026540.
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:

1. Problem Solving Procedure & Strategies
2. Sets, Whole Number, and Numeration
3. Whole Number Operations and Properties
4. Mental, Written, and Electronic Whole Number Computation

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: Candidates will be able to:

1. Candidates will be able to state Polya's Four Steps to Problem Solving.
2. Candidates will be able to describe and use Polya's four steps to problem solving.
3. Candidates will be able to list several methods of problem solving as outlines in the book.
4. Candidates will learn to use the *Guess & Test, Draw a Picture, Use a Variable, Look for a Pattern, Make a List, Solve a Simpler Problem, Draw a Diagram,* and *Use Direct Reasoning* and *Use Indirect Reasoning* strategies to solve higher-order mathematics problems.
5. Use concrete and virtual manipulative tools to model and solve problems.
6. Candidates will know the definition for each of the following terms: Set, element, members, set builder notation, equal, one – to – one correspondence sub set, equivalent, proper subset, disjoint, union, intersection, complement, relative complement, Cartesian product.
7. Candidates will know the symbols for all set separations and relations.
8. Candidates will be able to explain the definitions in their own words on by making drawings illustrating same concepts.
9. Candidates will be able to use Venn Diagrams in solving various set problems.
10. Candidates will know the definition of both number and numeral.
11. Candidates will be able to explain the difference between numbers and numeral.
12. Candidates will know the difference use of numbers.
13. Candidates will be able to determine the cardinality of a set of be able to produce a set of a give cardinality.
14. Candidates will know and be able to apply the definitions of the ordering of whole numbers.
15. Candidates will know the symbols for the Tally, Egyptian, and Roman base numeration systems.
16. Candidates will be able to convert to and from the Tally, Egyptians, Roman and Mayan systems and base ten.
17. Candidates will be able to describe the Hindu-Arabic Numeration system.
18. Candidates will be able to describe and illustrate base ten concepts using bundles of sticks and base ten pieces.
19. Candidates will be able to describe, write and represent numbers in various bases.
20. Candidates will be able to convert between a base other than ten and a base ten.
21. Candidates will be able to convert between base ten and various other bases.
22. Candidates will be able to express numbers in both expanded and standard forms.
23. Candidates will be able to explain the all the parts of the definition of addition.
24. Candidates will be able to explain and use the closure property with respect to addition.
25. Candidates will be able to explain and use the commutative property for whole number addition.
26. Candidates will be able to draw pictures illustrating the commutative property for whole number addition.
27. Candidates will be able to explain and use the Associative Property for Whole Number Addition.
28. Candidates will be able to draw pictures illustrating the Associative Property for Whole Number Additions.
29. Candidates will be able to explain and use the Identity Property of Whole Number Addition.
30. Candidates will be able to explain the uses of both set and measure models.
31. Candidates will be able to explain the take – away and missing – addends definitions of subtraction.
32. Candidates will be able to use and explain the take-away, missing –addends, and comparison approaches to subtraction.
33. Candidates will be able to explain all of the parts of the definitions of multiplication by repeated addition.
34. Candidates will be able to use the definition of multiplication by repeated addition.
35. Candidates will be able to explain all of the parts of the definition of multiplication by rectangle array.
36. Candidates will be able to use the rectangular array definition of multiplication.
37. Candidates will be able to explain the definitions of multiplication by Cartesian product.
38. Candidates will be able to use the Cartesian product form of multiplication.
39. Candidates will be able to illustrate each definition of multiplication using either set or measurement models.
40. Candidates will be able to explain, use and illustrate the Closure Property for multiplication of Whole Numbers.
41. Candidates will be able to explain, use and illustrate the Identity Property for Whole Number Multiplication.
42. Candidates will be able to explain, use and illustrate the Distributive Property of Multiplication over Addition.
43. Candidates will be able to explain, use and illustrate the Distributive Property of Multiplication over Subtraction.
44. Candidates will be able to explain, use and illustrate multiplication property of Zero.
45. Candidates will be able to explain and use the definition of Division by Missing Factor.

46. Candidates will be able to explain and use the Division Algorithm.
47. Candidates will be able to explain and use the definition of 'Less Than' for Whole Numbers.
48. Candidates will be able to explain and use the Transitive Property of 'Less Than' for Whole-Numbers.
49. Candidates will be able to explain and use the definition of While Number Exponents.
50. Candidates will be able to explain and use all of the Theorems related to Exponents.
51. Candidates will be able to explain why the definition of Zero as Exponents makes sense.
52. Candidates will be able to use right distribution of division over addition.
53. Candidates will be able to explain and use Compatible numbers.
54. Candidates will be able to explain and use addition compensation, equal addition compensation and multiplication compensation.
55. Candidates will be able to explain and use Multiplications of Special Factors.
56. Candidates will be able to use Front-End Estimation with various numbers of columns being used.
57. Candidates will be able to use Front-End Estimation with Adjustment with various numbers of columns being used.
58. Candidates will be able to use Rounding of numbers.
59. Candidates will be able to use Construction of Numbers.
60. The candidates should know and understand the definition of algorithm.
61. The candidates should be able to use the standard algorithm for addition in any base from either left or right.
62. The candidates should be able to use Intermediate Algorithm One from either left or right.
63. The candidates should be able to use the lattice method for addition.
64. The candidates should be able to use the standard algorithm for subtraction.
65. The candidates should be able to use the subtraction from the base algorithm.
66. The candidates should be able to use Austrian Algorithm.
67. The candidates should be able to draw and use base blocks to illustrate both addition and subtraction problems.
68. The candidates should be able to draw and use Chip Abacus to illustrate both addition and subtraction problems.
69. The candidates should be able to use the standard multiplication algorithm.
70. The candidates should be able to use the lattice algorithm for multiplication.
71. The candidates should be able to use base blocker to illustrate multiplication in any base.
72. The candidates should be able to explain how the distributive property of multiplication over addition is used with any algorithm.
73. The candidates should be able to use the long division algorithm.
74. The candidates should be able to use base blocks to illustrate division.
75. The candidates should be able to use scaffold method of division.
76. The candidates should be able to use the Equal Additions Algorithm.
77. The candidates should be able to explain the Equal Additions Algorithm.
78. Critique the relevance, customization, feedback thinking skills, usability, engagement, and sharing of educational application tools.
79. 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 a 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 (1^{st} response = 10 pts., 2^{nd} response = 5 pts., 3^{rd} response = 2 points, 4^{th} or 5^{th} response = 0 points). Your team will also be given the opportunity to write a 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: *Problem Solving Procedure & Strategies* Weeks 1-4		
Weeks 1 – 4 (Monday, January 12th – Sunday, February 8th)	◊ Describe and use Polya's four-step procedure to solve problems. ◊ Describe and use the *Guess & Test, Draw a Picture, Use a Variable, Look for a Pattern, Make a List, Solve a Simpler Problem, Draw a Diagram,* and *Use Direct Reasoning* strategies to solve problems. ◊ Produce multiple representations of their solutions to problems. ◊ Use spreadsheets to model patterns. ◊ Use virtual manipulative tools to model and solve problems.	◊ Read Chapter 1 ◊ Readiness Assurance Test (January 15, 2015) ◊ Independent Assignments: o 1.1 Due: 1/25/15 o 1.2 Due: 2/1/15 ◊ TEST ONE: 2/5/15
Instructional Sequence Two: *Sets, Whole Number, and Numeration* Weeks 5-7		
Week 5-7 (Monday, February 9th – Sunday, March 1st)	◊ Define: set, element, one – to – one correspondence, subset, proper subset, equal, equivalent, disjoint, union, intersection, complement, relative complement, Cartesian product. ◊ Use set notation to model and solve problems. ◊ Use Venn Diagrams to model and solve problems. ◊ Explain the difference between a number and a numeral. ◊ Determine the cardinality of a set and be able to produce a set of a given cardinality. ◊ Order whole numbers. ◊ Convert to and from the Tally, Babylonian, Egyptians, Roman, and Mayan systems and the Hindu-Arabic Numeration system. ◊ Describe and illustrate base ten concepts using bundles of sticks and base ten blocks. ◊ Describe, write and represent numbers in various bases. ◊ Convert between a base other than ten and a base ten. ◊ Express numbers in both expanded and standard forms.	◊ Read Chapter 2 ◊ Readiness Assurance Test (February10 , 2015) ◊ Independent Assignments: o 2.1 Due: 2/15/15 o 2.2 due: 2/20/15 o 2.3 due: 2/24/15 ◊ TEST TWO: 2/26/15
Instructional Sequence Three: *Whole Number Operations and Properties* Weeks 8-11		
Weeks 8-11 (Monday, March 2nd – Sunday, April 5th)	◊ Use a set model and set notation to represent and solve addition and subtraction problems. ◊ Use a measurement model to represent and solve addition, subtraction, and multiplication problems. ◊ Explain and use the Identity, Commutative, and Associative properties of addition and multiplication. ◊ Explain and use the take-away, missing – addends, and comparison	◊ Read Chapter 3 ◊ Readiness Assurance Test (March 3, 2015) ◊ Independent Assignments: o 3.1 Due: 3/15/15 o 3.2 due: 3/22/15

	approaches to subtraction. ◊ Explain and use the definition of multiplication as repeated addition, rectangle array, and Cartesian product. ◊ Explain and use the Distributive Property of Multiplication over Addition and Distributive Property of Multiplication over Subtraction. ◊ Explain and use the Multiplication Property of Zero. ◊ Explain and use the definition of Division by Missing Factor and the Division Algorithm. ◊ Explain and use the definition of Less Than and the Transitive Property of Less Than for Whole Numbers. ◊ Explain, evaluate, and simplify exponential expressions.	○ 3.3 due: 3/31/15 ◊ Math Literacy assignment due: 4/2/15 ◊ TEST THREE: 4/2/15
Instructional Sequence Four: ***Mental, Written, and Electronic Whole Number Computation*** **Weeks 12-14**		
Weeks 12-14 (Monday, April 6th – Sunday, April 26th)	◊ Explain and use estimation methods to mentally solve arithmetic problems. ◊ Explain, use, and model the standard algorithms for addition, subtraction, multiplication, and division. ◊ Explain and use the lattice method to solve multiplication problems. ◊ Explain and use the scaffold method to solve division problems. ◊ Explain and use the equal additions algorithm.	◊ Read Chapter 4 ◊ Readiness Assurance Test (April 7, 2015) ◊ Independent Assignments: ○ 4.1 due: 4/12/15 ○ 4.2 due: 4/19/15 ○ 4.3 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 8 AM 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 (i.e. illness; personal crisis), 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 your droppable grades to offset any unforeseen low scores or difficulties 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:

Liza Cope, Ph.D.
lcope@deltastate.edu
Department of Mathematics
Broom Hall 282, Phone 662-846-4512

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.