# COURSE SYLLABUS

<table>
<thead>
<tr>
<th>Course Number:</th>
<th>MAS 4203</th>
<th>Course Title:</th>
<th>Number Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite(s):</td>
<td>Calculus III and Linear Algebra</td>
<td>Course Credit:</td>
<td>3 hours</td>
</tr>
<tr>
<td>College:</td>
<td>Arts &amp; Sciences</td>
<td>Course Hours:</td>
<td>Lecture 3 hours</td>
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<tr>
<td>Department:</td>
<td>Mathematics</td>
<td>Required Text(s):</td>
<td>Elementary Number Theory, by David Burton</td>
</tr>
<tr>
<td>Faculty Name:</td>
<td>Dr. Roselyn E. Williams</td>
<td>Term and Year:</td>
<td>Fall 2008</td>
</tr>
<tr>
<td>Office Location:</td>
<td>Jackson Davis, room 403</td>
<td>Place and Time:</td>
<td></td>
</tr>
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<table>
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<tr>
<th>Office Hours</th>
<th>Monday 3:30-5:00</th>
<th>Tuesday 3:30-5:00</th>
<th>Wednesday 3:30-5:00</th>
<th>Thursday 3:30-5:00</th>
<th>Friday 3:30-5:00</th>
<th>Saturday</th>
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**Course Description**

This course is designed to assist students in developing skills for solving linear Diophantine equations, primes, and their distribution. In addition, students will investigate mathematical induction, the theory of congruence, and the history of mathematics. Also, students will examine number theoretic functions.

**Conceptual Framework**

The Conceptual Framework in the Professional Education Unit (PEU) at Florida A&M University is an integrated approach to providing educational experiences that result in exemplary professional educators. The Framework is comprised of six themes with the mission of developing high quality classroom teachers, administrators and support personnel. The term “exemplary” refers to the kind of graduates the PEU strives to produce. The figure below provides a diagram of the Exemplary Professional Conceptual Framework.

The Conceptual Framework for the FAMU Professional Education Unit is grounded in a combination of directed, constructivist, developmental, and social learning theories derived from the writings of system theorists, educational philosophers, social scientists, practitioner and developmental theorists. Concepts from these writers and from the varied educational learned societies help form the knowledge base for the unit’s curriculum components and principles of its Conceptual Framework.

**F=**Florida Educator Accomplished Practices Standards (FEAPS)

**I=**Interstate New Teacher Assessment and Support Consortium Standards (INTASC)

(K)=Knowledge  (S)=Skill  (D)=Disposition
CRITICAL THINKING

- CF4
  - Through this focal area, the FAMU professional education candidate will:

| CF: 4.1 (K) | Understand a variety of instructional/professional strategies to encourage student development of critical thinking and performance. | F: 4,7 | I: 4 |
| CF: 4.4 (K) | Acquire performance assessment techniques and strategies that measure higher order thinking skills of student. | F: 1,4 | I: 1.8 |
| CF: 4.5 (S) | Demonstrate the use of higher order thinking skills. | F: 8 | I: 4 |

PROFESSIONALISM

- CF 5
  - Through this focal area, the FAMU professional education candidate will:

| CF: 5.1 (K) | Know the content | F: 8 | I: 1 |

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Approved/Revised 10/30/07
**Overall Goals of the Course**

The overall goal of the course is to cover as many topics as possible, allowing for maximum learning of the subject and appreciation of the text. This course is designed to be a reading and writing course. The text is designed to be covered in one semester.

**Specific Behavioral Objectives**

To successfully complete Number Theory, the student will be required to meet the following objectives with at least 70% proficiency. At the end of the course the student will be able to:

**Knowledge of the basic concepts of set theory**

1. Apply the basic concepts of set theory

**Comprehension of Number theory**

1. Apply prime factorization.
2. Define GCD and LCM.
3. Explain divisibility test and why they work (divisors 2, 3, 4, 5, 8, 9, and 10).
4. Define prime and composite numbers.
5. Use laws of exponents to evaluate expressions.
6. Use scientific notation.

**Knowledge of the binomial theorem**

1. Expand given binomials to a specified positive integral power.
2. Determine a specified term in the expansion of given binomials.

**Ability to apply the axiomatic approach in developing proofs for theorems**

1. State conditionals in "if-then" form and identify the hypotheses and conclusion.
2. State the converse, inverse, and contrapositive of a conditional.
3. Draw correct conclusions form given statements.
4. Identify point, line, and plane as undefined terms and use symbols for lines, segments, rays, and distances.
5. Differentiate among undefined terms, definitions, postulates, and theorems.
6. Use algebraic postulates.
7. Write simple proofs in two-column form.
8. Write indirect proofs.
9. Classify conclusions as examples of inductive or deductive thinking.

**National, State, and PEU Standards Addressed in the Course**

**Interstate New Teacher Assessment and Support Consortium (INTASC) Standards**

**Standard 1: Subject Matter**
The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

**Standard 6: Communication**
The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.

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Standard 8: Assessment
The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social and physical development of the learner.

Professional Organization/Learned Society Standards

NCATE/NCTM Program Standards for Secondary Mathematics:

Standard 1: Knowledge of Mathematical Problem Solving
Candidates know, understand, and apply the process of mathematical problem solving.

Standard 2: Knowledge of Reasoning and Proof
Candidates reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry.

Standard 3: Knowledge of Mathematical Communication
Candidates communicate their mathematical thinking orally and in writing to peers, faculty, and others.

Standard 4: Knowledge of Mathematical Connections
Candidates recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding.

Standard 5: Knowledge of Mathematical Representation
Candidates use varied representations of mathematical ideas to support and deepen students’ mathematical understanding.

Standard 9: Knowledge of Number and Operation
Candidates demonstrate computational proficiency, including a conceptual understanding of numbers, ways of representing number, relationships among number and number systems, and meanings of operations.

Standard 10: Knowledge of Different Perspectives on Algebra
Candidates emphasize relationships among quantities including functions, ways of representing mathematical relationships, and the analysis of change.

Florida Educator Accomplished Practices (FEAPs)

ASSESSMENT
The preprofessional teacher collects and uses data gathered from a variety of sources. These sources include both traditional and alternate assessment strategies. Furthermore, the teacher can identify and match the students’ instructional plans with their cognitive, social, linguistic, cultural, emotional, and physical needs.

COMMUNICATION
The preprofessional teacher recognizes the need for effective communication in the classroom and is in the process of acquiring techniques which she/he will use in the classroom.

CRITICAL THINKING

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The preprofessional teacher is acquiring performance assessment techniques and strategies that measure higher order thinking skills in students and is building a repertoire of realistic projects and problem-solving activities designed to assist all students in demonstrating their ability to think creatively.

**KNOWLEDGE OF SUBJECT MATTER**
The preprofessional teacher has a basic understanding of the subject field and is beginning to understand that the subject is linked to other disciplines and can be applied to real-world integrated settings. The teacher’s repertoire of teaching skills includes a variety of means to assist student acquisition of new knowledge and skills using that knowledge.

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**Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE) Competencies and Skills**

1 **Knowledge of algebra**
20. Expand given binomials to a specified positive integral power.
21. Determine a specified term in the expansion of given binomials.

8 **Knowledge of discrete mathematics**
5. Evaluate matrix expressions involving sums, differences, and products.

10. **Knowledge of number sense and mathematical structure**
4. Apply number theory concepts (e.g., primes, factors, multiples) in real-world and mathematical problem situations.

11 **Knowledge of mathematics as communication**
1. Identify statements that correctly communicate mathematical definitions or concepts
2. Interpret written presentations of mathematics.
3. Select or interpret appropriate concrete examples, pictorial illustrations, and symbolic representations in developing mathematical concepts.

12 **Knowledge of mathematics as reasoning**
1. Identify reasonable conjectures.
2. Identify a counter example to a conjecture.
4. Identify proofs for mathematical assertions, including direct and indirect proofs, proofs by mathematical induction, and proofs on a coordinate plane.
5. Identify process skills: induction, deduction, questioning techniques, and observation-inference.

13 **Knowledge of mathematical connections**
1. Identify equivalent representations of the same concept or procedure (e.g., graphical, algebraic, verbal, numeric).

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*Approved/Revised 10/30/07*
Teaching Methods

Teaching method will be lecture.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Behavioral objectives</th>
<th>INTASC Standards</th>
<th>NCTM</th>
<th>FEAPs</th>
<th>FTCE SAE</th>
<th>PEU Conceptual Framework</th>
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<tbody>
<tr>
<td>Mathematical Supplementary Problem 4 (Homework)</td>
<td>Identify proofs for mathematical assertions, including direct and indirect proofs, proofs by mathematical induction, and proofs on a coordinate plane.</td>
<td>INTASC: 1.0, 8.0</td>
<td>NCTM: 1.1, 1.3, 3.2, 4.1, 9.5</td>
<td>FEAPs: 1.1, 4.1, 4.1a, 4.1d, 4.1g, 8.1, 8.1a, 8.1b</td>
<td>FTCE: 8.5, 11.1, 11.2, 12.1, 12.4</td>
<td>CF 4.1, CF 4.3, CF 4.5, CF 5.1</td>
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<tr>
<td>Mathematical Supplementary Problem 20 (Homework)</td>
<td>Evaluate matrix expressions involving sums, differences, and products.</td>
<td>INTASC: 1.0, 8.0</td>
<td>NCTM: 1.1, 1.3, 2.1, 2.2, 2.3, 2.4, 3.2, 4.1, 9.5</td>
<td>FEAPs: 1.1, 4.1, 4.1a, 4.1d, 4.1g, 8.1, 8.1a, 8.1b</td>
<td>FTCE: 8.5, 11.1, 11.2, 11.3, 12.1</td>
<td>CF 4.1, CF 4.3, CF 4.5, CF 5.1</td>
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<tr>
<td>Mathematical Supplementary Problem 30 (Homework)</td>
<td>Identify reasonable mathematical conjectures.</td>
<td>INTASC: 1.0, 8.0</td>
<td>NCTM: 1.1, 1.3, 2.1, 2.2, 2.3, 2.4, 3.2, 4.1, 9.5</td>
<td>FEAPs: 1.1, 4.1, 4.1a, 4.1d, 4.1g, 8.1, 8.1a, 8.1b</td>
<td>FTCE: 8.5, 11.1, 11.2, 12.1</td>
<td>CF 4.1, CF 4.3, CF 4.5, CF 5.1</td>
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Course Evaluation

Your course grade will be:

Tests (average of highest 3 of 4) 100
Assignments and Quizzes 10
Total 110

Grading

The scale will be:

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Approved/Revised 10/30/07
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<th>Date</th>
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<td>27-Aug</td>
<td>1.1</td>
<td>1.1.8</td>
<td>1.1.9</td>
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<td>29-Aug</td>
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<td>1.2.3.a</td>
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<td>3-Sep</td>
<td>1.2</td>
<td>Sup 20</td>
<td>Sup 30</td>
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<td>5-Sep</td>
<td>2.1</td>
<td>Sup 7</td>
<td>Sup 14 c, e</td>
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<td>10-Sep</td>
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<td>Sup 32</td>
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<td>Sup 33</td>
<td>Sup 36</td>
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<td>4.4</td>
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<table>
<thead>
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<th>Date</th>
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<td>8.2.3 8.2.5 8.4.1</td>
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<td>1-Dec</td>
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<td>5-Dec</td>
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<td>9-Dec</td>
<td>Comprehensive Final</td>
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**Topical Outline**

**Test One**

- Mathematical Induction
- The Binomial Theorem
- The division Algorithm
- The Greatest Common Divisor
- The Euclidean Algorithm
- Diophantine Equations
- The Fundamental Theorem of Arithmetic
- The Sieve of Eratosthenes and the Goldbach Conjecture

**Test Two**

- The Theory of Congruence
- Special Divisibility Tests
- Linear Congruences
- Fermat's Little Theorem
- Fermat's Factorization Method
- Wilson's Theorem
- The number theoretic functions, $\sigma$ and $\tau$
- The Greatest Integer Function

**Test Three**

- Euler's Phi function
- Euler's Theorem
- Primitive Roots and Indices
- The Quadratic Reciprocity Law
- Euler's Criterion
- The Legendre Symbol and its Properties

**Course Policies**

**Policy Statement on Non-Discrimination** It is the policy of Florida Agricultural and Mechanical University to assure that each member of the University community be permitted to work or attend classes in an environment free from any form of discrimination including race, religion, color, age, disability, sex, marital

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status, national origin, veteran status and sexual harassment as prohibited by state and federal statutes. This shall include applicants for admission to the University and employment.

**Academic Honor Policy** The University’s Academic Honor Policy is located in the FANG Student Handbook, under the Student Code of Conduct- Regulation 2.012 section, beginning on page 55-56.

**ADA Compliance** To comply with the provisions of the Americans with Disabilities Act (ADA), please advise instructor of accommodations required to insure participation in this course. Documentation of disability is required and should be submitted to the Learning Development and Evaluation Center (LDEC). For additional information please contact the LDEC at (850) 599-3180.

**References**

Burton, D. *Elementary Number Theory*.


www.ncate.org

www.fldoe.org