

Fayetteville State University
College of Arts and Sciences
Department of Mathematics and Computer Science
MATH472 Theory of Numbers
Fall 2011

I. Locator Information

Instructor: Dr. Yufang Bao

Course Number and Name: MATH472-01, Theory of Numbers

Semester Credit Hours: 3

Day, Time and Place Class Meets: TR 9:30 am -10:45 am., SBE 106

Total Contact Hours for Class: 45

Email address: ybao@uncfsu.edu

Office Location: LSB 127

Office hours:

T 12:30 pm -4:30 pm LSB 127, W 2:00 pm -4:00 pm at SBE 214, F 12:00pm-2:00pm LSB127

Office Phone: 672-2437

FSU Policy on Electronic Mail: Fayetteville State University provides to each student, free of charge, an electronic mail account (username@uncfsu.edu) that is easily accessible via the Internet. The university has established FSU email as the primary mode of correspondence between university officials and enrolled students. Inquiries and requests from students pertaining to academic records, grades, bills, financial aid, and other matters of a confidential nature must be submitted via FSU email. Inquiries or requests from personal email accounts are not assured a response. The university maintains open-use computer laboratories throughout the campus that can be used to access electronic mail.

Rules and regulations governing the use of FSU email may be found at <http://www.uncfsu.edu/PDFs/EmailPolicyFinal.pdf>

II. Course Description

A study of the elementary properties of integers, invisibility, Euclid's Algorithm, prime numbers, and congruences. **Prerequisite:** MATH 260.

III. Disabled Student Services

In accordance with Section 504 of the 1973 Rehabilitation Act and the Americans with Disabilities Act (ACA) of 1990, if you have a disability or think you have a disability to please contact the Center for Personal Development in the Spaulding Building, Room 155 (1st Floor); 910-672-1203.

IV. Textbook

ELEMENTARY NUMBER THEORY (2nd Ed), VANDEN EYNDEN, 2001, Waveland Press.

V. Student Learning Outcomes

Upon completion of this course students will be able to:

1. Apply the Euclidean Algorithm in computing GCD and LCM and in finding integer solutions of linear equations.
2. Describe patterns and relations and apply them to model and solve problems.
3. Demonstrate the ability of using various techniques, like direct and indirect proofs and mathematical induction to proof propositions.
4. Communicate mathematical ideas clearly.
5. Utilize the Fundamental Theorem of Arithmetic in computing of various numerical functions.
6. Apply the concept of multiplicative functions in computations.
7. Solve linear and polynomial congruences.
8. Utilize the algebra of congruence classes and the theorems of Fermat and Euler.
9. Apply the quadratic reciprocity law in computing the Legendre symbol.

DPI COMPETENCIES

The DPI competencies covered are listed below:

6.1 Understand elementary number theory including modular arithmetic, the Fundamental Theorem of Arithmetic, basic results about primes, composites, multiples and divisors.

NCATE STANDARDS

The NCATE Standards covered in this course are listed below:

1.1.7 Use algebra to describe patterns, relations and functions, and to model and solve problems

1.1.9 Understand the role of axiomatic systems and proofs in different branches of mathematics, such as algebra and geometry

1.1.11 Describe and represent mathematical relationships

VI. Course Requirements and Evaluation Criteria

The emphasis in this course will be more on proofs and less on computation. Proofs could be as short as a line and as long as several pages. The “one-liners” may be ingenious and the longer ones may be straightforward. So do not judge the difficulty of the proofs by their length. Always have a paper and pencil ready as you read the text. You will often need time as you “plow through” your reading. One learns to do proofs by doing them than reading them. This may be a little frustrating to begin with, so do not despair!

Write your proofs with a reader in mind. The proof should not only convince you, but it must convince others. Write your proofs in complete English sentences and provide clear transitions.

You are not banned from collaborating with other members of the class on homework problems but do not write down something that you do not understand!

Students are encouraged to ask questions of the instructor in class and to respond to those posed by the instructor. They should not discourage others from raising or answering questions. Often, other students have the same question which they wish to ask, but are hesitant to do so.

Students are expected to attend classes regularly and do all of the assignments.

FN	Hours attempted – Not earned	0 per credit hour	Failing due to non-attendance. (Student registered, but <u>never</u> attended.)
W	Hours attempted – Not earned	No impact on GPA	Class withdrawal prior to deadline (see Academic Calendar)
P	Hours attempted and earned	No impact on GPA	Satisfactory - Assigned only in classes specified as Pass/Fail
WU	Hours attempted – Not earned	No impact on GPA	Withdrawal from all classes for semester or term
AU	Hours attempted – Not earned	No impact on GPA	Auditing

- a. Attendance Requirements – The FSU Attendance Policy stated on page 73 of the 2008-2009 University Catalogue will be strictly enforced. **Three (3) late arrivals** and/or **early departures** will count as one absence. Exceeding the limit of **four (4) unexcused absences** will result in an interim grade **EA = EXCESSIVE ABSENCES**. When a student enters the classroom after the roll call, it is the responsibility of the student to inform the instructor after class that (s)he was in attendance. You must notify the instructor when it is necessary for you to leave early.

Notice that:

- **Students receive no refund for withdrawing from individual classes and they slow their progress toward degree completion.**

- **Students who withdraw from or fail more than one-third of their classes will no longer be eligible for financial aid.**
- **STUDENTS MUST STRIVE TO EARN CREDIT FOR ALL THE CLASSES IN WHICH THEY ENROLL. STUDENTS SHOULD WITHDRAW FROM CLASSES ONLY WHEN IT IS ABSOLUTELY NECESSARY.**

- b. Graded Assignments – There will be three homeworks, three tests - weighted the same and the lowest test score will be dropped, and a comprehensive final exam (see the schedule). The weight given to various activities for evaluation is as follows: tests-60%, final exam-20%, and homeworks-20%. There will be some extra credit from unannounced quizzes.

Grading Scale:

A: 90-100	B: 80-90	C: 70-80	D: 60-70	F: below 60
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- c. Policy on **Missed or Late Assignments** - Late homework will no longer be accepted after it has been graded and returned to class. If homework is given to me the day after it is due, it will lose 20% of its total value. For two days delay it will lose 40% of its total value and so on. . **No make up tests for unexcused absences! For excused absences student should contact the instructor prior to the test!**
- d. Other - Dishonesty on graded assignments will not be tolerated. Students must neither give nor receive help on any work to be graded. The University policy on cheating will be applied to any violations. The minimum penalty will be a grade of zero on the assignment (including tests).

Please note: If these evaluation criteria must be revised because of extraordinary circumstances, the instructor will distribute a written amendment to the syllabus.

Student Behavior Expectations: -The instructor will respect all students and will make every effort to maintain a classroom climate that promotes learning for all students. Students must accept their responsibility for maintaining a positive classroom environment by abiding by the following rules:

1. Students are expected to arrive to class on time, remain in class until dismissed by the instructor, and refrain from preparing to leave class until it is dismissed.
2. Student/teacher relationships, as well as relationships among peers, must be respectful at all times.
- 3 Students are not permitted to wear headphones or other paraphernalia that may be distracting to the classroom environment.
4. Students must refrain from any activity that will disrupt the class; this includes turning off cell phones and pagers.
5. Students are not permitted to use profanity in the classroom.
6. Students will not pass notes or carry on private conversations while class is being conducted.

Consequences for Failing to Meet Behavioral Expectations: The first time a student violates one of these rules, the instructor will warn him or her privately, either after class or before the next class. (Faculty members reserve the right to warn students publicly if needed.) The second time a student violates the guidelines, the instructor may deduct as many as twenty points from the student's next exam grade. If a student violates the guidelines three times, the instructor will report the student to the Dean of Students for disciplinary action according to the FSU Code of Student Conduct.

VII. Academic Support Resources

Students are encouraged to use the Blackboard Learning System where lecture notes, solutions to problems, and other materials will be posted.

VIII. Course Outline and Assignment

***The following Course Outline and Assignments are subject to change if appropriate.**

Topic Covered	Practice Problems
1.1 The GCD and LCM	6, 8, 16, 26, 34
1.2 The Division Algorithm	2, 10, 14, 16, 18, 32
1.3 The Euclidean Algorithm	4, 14, 18, 21, 29
1.4 Linear Combinations	2, 8, 14, 24, 36
1.5 Congruences	2, 18, 32, 38, 45
1.6 Mathematical Induction	11, 17, 23, 35, 53
Review 1, Homework 1 & 2 are due	
Test 1	
2.1 Prime Factorization	4, 10, 14, 18
2.2 The Fundamental Theorem of Arithmetic	8, 10, 16, 22
2.3 The Importance of Unique Factorization	2, 6, 8, 11, 20, 28
2.4 Prime Power Factorizations	2, 10, 18, 28, 34
2.5 The Set of Primes is Infinite	2, 10, 14, 16
2.6 A Formula $T(n)$	10, 12, 20, 23, 24, 32
Homework 3 is due	
3.1 The Sum of the Divisors	10, 14, 23, 26, 38, 40, 46
3.2 Multiplicative Functions	8, 10, 13, 22, 23
3.3 Perfect Numbers	6, 12, 19, 22, 26
Review 2	
Test 2	
3.4 Mersenne and Fermat Numbers	1, 6, 10, 16

3.5 The Euler Phi Function	4, 12, 18, 22, 41
3.6 The Mobius Inversion Formula	2, 12, 14, 18
Homework 4 is due	
4.1 Solving Linear Congruences	6, 14, 18, 26, 42, 44
4.2 The Chinese Remainder Theorem	6, 16, 24, 32, 42
Review 3	
Test 3	
4.3 The Theorems of Fermat and Euler	2, 10, 14, 20, 28
4.4 Primality Testing	4, 8, 12, 20
4.5 Public-Key Cryptography	4, 10, 22, 30, 34
5.1 Polynomial Congruences	4, 14, 24, 28, 32
Homework 5 is due	
5.2 Congruences with Prime Power Moduli	2, 14, 19, 24
5.3 Quadratic Residues	4, 12, 22, 28, 32
5.4 Quadratic Reciprocity	4, 12, 18, 28
Review 4	
Test 4	
Review for the Final Exam	
Final Exam	

IX. Teaching Strategies: The majority of the material of the course will be given in lecture format. Participation in problem solving and discussions is strongly encouraged.

X. Bibliography:

1. Burton, David M. Elementary Number Theory. 4th ed., McGraw-Hill 1998.
2. Burton, David M. The History of Mathematics., 3^d ed., McGraw-Hill
3. Koblitz, Neal., A Course in Number Theory., 2nd ed., Springer-Verlag, New York.
4. Rose, H.E., A Course in Number Theory., 2nd ed., Oxford Univ Press., New York.