

# Math 111: Theory Of Numbers

## Catalog Description

**111. Theory of Numbers.** Lecture, three hours; discussion, one hour. Prerequisites: courses 110A or 117, and 115A. Divisibility, congruences, Diophantine analysis, selected topics in the theory of primes, algebraic number theory, Diophantine equations.

## General Information

Number theory is among the oldest and broadest branches of mathematics. It has roots going back to ancient babylonian cuneiform tablets, and it is the subject of several books in Euclid's *Elements*. Number theory has played an important role in the development of mathematics. Today number theory cuts across virtually every field of contemporary mathematics.

The most important mathematical event of the past decade has been the resolution of a famous problem that had been around since Fermat stated that a certain Diophantine equation (Fermat's equation,  $x^n+y^n=z^n$  for  $n$  larger than 2) does not have any positive integer solutions. The assertion defied numerous proof attempts over a period of 400 years, until recently it was proved as a result of work of Andrew Wiles and other mathematicians, using many of the modern techniques of number theory that have been developed over the past 30 years.

Perhaps the most famous remaining open problem in mathematics is the *Riemann hypothesis* on the location of the zeros of a specific meromorphic function, the *Riemann zeta function*. The location of the zeros has consequences for the asymptotic distribution of prime numbers.

Prime numbers are of great concern in connection with mathematical cryptography, entering into the construction of public key encryption codes. This illustrates how number theory ties in with various areas, ranging in this case from complex analysis to areas of current business and governmental security interest.

Because number theory is so vast, there is no one course that could serve as a good introduction to the entire field. Several possibilities for class syllabi are given, each of which focuses on a different emphasis. It may be that the course instructor will follow yet a different path.

## Recent Enrollment Statistics

Year	Fall	Winter	Spring
1993-1994	(no sections)	(no sections)	16 (1 section)
1994-1995	(no sections)	(no sections)	27 (1 section)
1995-1996	(no sections)	(no sections)	19 (1 section)
1996-1997	(no sections)	(no sections)	(no sections)
1997-1998	9 (1 section)	(no sections)	(no sections)
1998-1999	(no sections)	(no sections)	(no sections)
1999-2000	(no sections)	(no sections)	40 (1 section)
2000-2001	(no sections)	(no sections)	27 (1 section)
2001-2002	(no sections)	(no sections)	20 (1 section)
2002-2003	(no sections)	30 (1 section)	(no sections)
2003-2004	(no sections)	11 (1 section)	(no sections)

