Course Code	MTH512
Course Name	Algebraic Number Theory
Credits	4
Course Offered to	PG
Course Description	An algebraic number field is a field obtained by adjoining to the rational numbers the roots of an irreducible rational polynomial. Algebraic number theory is the study of properies of such fields. This course will cover the following topics: number fields, rings of integers, factorization in Dedekind domains, class numbers and class groups, units in rings of integers , valuations and local fields, and if time permits decomposition of primes, and zeta functions of number fields. These tools provide solutions to several problems which are elementary to state but surprisingly difficult to resolve, including Pell's equation, quadratic reciprocity, the two squares theorem and the four squares theorem (every positive integer is a sum of four square integers).

Pre-requisites

Pre-requisite (Mandatory)	**Pre-requisite (Desirable)**	**Pre-requisite(other)**
MTH211 Number Theory		
Group Theory		

Post Conditions*(For suggestions on verbs please refer the second sheet)

CO1	**CO2**	**CO3**	**CO4**	**CO5**
The students should be able to explain the key notions of algebraic number theory and outline their interrelation	The students should be able to summarize the fundamental theorems of the course and apply them in specific cases.	The students should be able to calculate the most important number theoretical quantities introduced during the course	The students should be able to explain the concept of "geometry of numbers" according to Minkowski.	

Weekly Lecture Plan

Week Number	**Lecture Topic**	**COs Met**	**Assignment/Labs/Tutorial**
1	Review of required tools from the theory of fields and rings, Field extensions, ideals, maximal ideals, prime ideals,	CO2	Assignment
2 and 3	Number Fields - Definitions and basic examples, Embeddings into the real and complex numbers, Field norms and trace	CO1, CO3	Assignment
4, 5, half of 6	Rings of Integers-Definitions and basic properties,Integral closures,discriminants, quadratic field extensions, cyclotomic fields	CO1, CO2, CO3	Assignment
half of 6, 7 and 8	Unique factorisation of ideals- Prime ideals in rings of integers of number fields, Unique factorisation into prime ideals, Geometry of numbers (Lattices, The Minkowski bound)	CO1, CO2, CO3, CO4	Assignment
9 and 10	Failure of unique factorisation- Examples, Definition and finiteness of the class group, examples of computing class numbers using Minkowski bound.	CO3	Assignment
11	Applications- Applications to non-linear Diophantine equations, Some cases of Fermat's last theorem	CO1, CO2,CO3	Assignment
12 and 13	Paper Presentation	CO1,CO2,CO3,CO4	

*Please insert more rows if required

Weekly Lab Plan

Week Number	**Laboratory Exercise**	**COs Met**	**Platform (Hardware/Software)**

*Please insert more rows if required

Assessment Plan

Type of Evaluation	**% Contribution in Grade**
Assignment	30
Paper presentation	25
Mid-sem	15
End-sem	30

Resource Material

Type	**Title**
Textbook	
Reference	Number Fields, Marcus, 1987, Springer -Verlag, NY
	Algebraic Number Theory by James Milne (online lecture notes available for free at www.jmilne.org/math/)
	Number Theory, Z. I. Borevich and I.R. Shafarevich, Academic Press