



MATHEMATICS

GALOIS THEORY



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IIT Bombay

TYPE OF COURSE	: New Core UG/PG	COURSE DURATION	: 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE	: BSc / BE /ME/ MSc / PhD	EXAM DATE	: 28 April 2019
PRE-REQUISITES	: Linear Algebra; Algebra – First Course		
INDUSTRIES APPLICABLE TO	: R&D Departments of IBM / Microsoft Research Labs SAP /TCS /Wipro / Infosys		

COURSE OUTLINE :

Galois Theory is showpiece of a mathematical unification which brings together several different branches of the subject and creating a powerful machine for the study problems of considerable historical and mathematical importance. This course is an attempt to present the theory in such a light, and in a manner suitable for undergraduate and graduate students as well as researchers. This course will begin at the beginning. These expressions are more complicated than their quadratic counterpart, but the fact that they exist comes as no surprise. It is therefore altogether unexpected that no such formulas are available for solving polynomials of degree ≥ 5 . A complete answer to this intriguing problem is provided by Galois theory. In fact Galois theory was created precisely to address this and related questions about polynomials. This feature might not be apparent from a survey of current textbooks on university level algebra. This course develops Galois theory from historical perspective and I have taken opportunity to weave historical comments into lectures where appropriate.

ABOUT INSTRUCTOR :

Dilip P. Patil received B. Sc. and M. Sc. in Mathematics from the University of Pune in 1976 and 1978, respectively. From 1979 till 1992 he studied Mathematics at School of Mathematics, Tata Institute of Fundamental Research, Bombay and received Ph. D. through University of Bombay in 1989. Currently he is a Professor of Mathematics at the Departments of Mathematics, Indian Institute of Science, Bangalore. At present he is a Visiting Professor at the Department of Mathematics, IIT Bombay. He has been a Visiting Professor at Ruhr-Universität Bochum, Universität Leipzig, Germany and several universities in Europe and Canada. His research interests are mainly in Commutative Algebra and Algebraic Geometry.

COURSE PLAN :

- Week 01** : Prime Factorisation in Polynomial Rings, Gauss's Theorem
- Week 02** : Algebraic Extensions
- Week 03** : Group Actions
- Week 04** : Galois Extensions
- Week 05** : Finite Fields, Cyclic Groups, Roots of Unity, Cyclotomic Fields
- Week 06** : Splitting Fields, Algebraic Closure
- Week 07** : Normal and Separable Extensions
- Week 08** : Norms and Trace
- Week 09** : Fundamental Theorem on Symmetric Polynomials
- Week 10** : Proof of the Fundamental Theorem of Algebra
- Week 11** : Orbits of the action of Galois group
- Week 12** : Inverse Galois Problem