Register for Certification exam

Course outline

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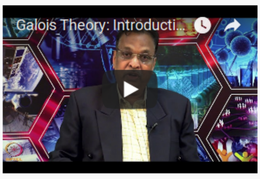
Galois Theory



969 students have enrolled already!!

ABOUT THE COURSE:

Galois Theory is showpiece of a mathematical unification which brings together several differentbranches of the subject and creating a powerful machine for the study problems of considerablehistorical and mathematical importance. This course is an attempt to present the theory in such alight, and in a manner suitable for undergraduate and graduate students as well as researchers.This course will begin at the beginning. The quadratic formula for solving polynomials of degree2 has been known for centuries and is still an important part of mathematics education. Thecorresponding formulas for solving polynomials of degrees 3 and 4 are less familiar. Theseexpressions are more complicated than their quadratic counterpart, but the fact that they exist comesas no surprise. It is therefore altogether unexpected that no such formulas are available for solvingpolynomials of degree ≥ 5. A complete answer to this intriguing problem is provided by Galoistheory. In fact Galois theory was created precisely to address this and related questions aboutpolynomials. This feature might not be apparent from a survey of current textbooks on universitylevel algebra.This course develops Galois theory from historical perspective and I have taken opportunity to weavehistorical comments into lectures where appropriate. It provides a platform for the developmentof classical as well as modern core curriculum of Galois theory. Classical results by Abel, Gauss,Kronecker, Legrange, Ruffini and Galois are presented and motivation leading to a modern treatmentof Galois theory. The celebrated criterion due to Galois for the solvability of polynomials by radicals.The power of Galois theory as both a theoretical and computational tool is illustrated by a study ofthe solvability of polynomials of prime degree.The participant is expected to have a basic knowledge of linear algebra, but other that the course islargely self-contained. Most of what is needed from fields and elementary theory polynomials ispresented in the early lectures and much of the necessary group theory is also presented on the way.Classical notions, statements and their proofs are provided in modern set-up. Numerous examplesare given to illustrate abstract notions. These examples are sort of an airport beacon, shining aclear light at our destination as we navigate a course through the mathematical skies to get there.Formally we cover the following topics :Galois extensions and Fundamental theorem of Galois Theory.Finite Fields, Cyclic Groups, Roots of Unity, Cyclotomic Fields.Splitting fields, Algebraic closureNormal and Separable extensionsSolvability of equations.Inverse Galois Problem

INTENDED AUDIENCE: BS / BSc / BE / ME / MSc / PhD

CORE/ELECTIVE: Core

UG/PG: UG and PG

PREREQUISITES: Linear Algebra ;Algebra – First Course

INDUSTRY SUPPORT: R & D Departments ofIBM / Microsoft Research LabsSAP /TCS / Wipro / Infosys

ABOUT THE INSTRUCTOR:

Prof. 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 PhD 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 LAYOUT:

Week 1 : Prime Factorisation in Polynomial Rings, Gauss's Theorem
Week 2 : Algebraic Extensions
Week 3 : Group Actions
Week 4 : Galois Extensions
Week 5 : Finite Fields, Cyclic Groups, Roots of Unity, Cyclotomic Fields
Week 6 : Splitting Fields, Algebraic Closure
Week 7 : Normal and Separable Extensions
Week 8 : Norms and Trace
Week 9 : Fundamental Theorem on Symmetric
Week 10 : Proof of the Fundamental Theorem Polynomial, of Algebra
Week 11 : Orbits of the action of Galois group
Week 12 : Inverse Galois Problem

SUGGESTED READING MATERIALS:

Artin, E. : Galois Theory, University of Notre Dame Press, 2 1944.[2] Artin, M. : Algebra, Prentice-Hall, 1994.[4] Jacobson, N. : Lectures in Abstract Algebra, Vols. I, II & III, D. Van Nostrand Co. Inc.,Princeton, New Jersey, 1966.[5] Jordan, C. : Traité des substitutions et des équations algébraiques, Gautjier-Villars, Paris,1870.[5] B. M. Kiernan, B. M. : The development of Galois theory from Lagrange to Artin, Arch.Hist. Exact Sci. 8 (1971 / 72) 40–54.[6] Lang, S. : Algebra, Graduate Texts In Mathematics, Vol. 211, Springer-Verlag, 3 2002.[6] Steinitz, E. : Algebraische Theorie der Körper, 2nd ed., Chelsea, 1950.[6] van der Waerden, B. L. : Die Algebra seit Galois, Jahresber Deutsch. Math. Verein. 68(1966), 155–165.[7] Weber, H. : Lehrbuch der Algebra, Band I, II, III, Braunschweug 2 1898, 2 1899, 2 1908.

CERTIFICATION EXAM :

- The exam is optional for a fee.
- Date and Time of Exams: **April 28 2019(Sunday)** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.
- Registration url: Announcements will be made when the registration form is open for registrations.
- The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published.

CERTIFICATION:

- Final score will be calculated as : 25% assignment score + 75% final exam score
- 25% assignment score is calculated as 25% of average of Best 8 out of 12 assignments
- E-Certificate will be given to those who register and write the exam and score greater than or equal to 40% final score. Certificate will have your name, photograph and the score in the final exam with the breakup.It will have the logos of NPTEL and IIT Bombay.It will be e-verifiable at nptel.ac.in/noc.