INTRODUCTION TO GALOIS THEORY

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PRE-REQUISITES : Courses in linear algebra, group theory, rings and fields are prerequisites.

INTENDED AUDIENCE : Final year B.Sc students or M.Sc students in mathematics.

COURSE OUTLINE :

In this introductory course on Galois theory, we will first review basic concepts from rings and fields, such as polynomial rings, field extensions and splitting fields. We will then learn about normal and separable extensions before defining Galois extensions. We will see a lot of examples and constructions of Galois groups and Galois extensions. We will then prove the fundamental theorem of Galois theory which gives a correspondence between subgroups of the Galois group and intermediate fields of a Galois extension. We will then cover some important applications of Galois theory, such as insolvability of quintics, Kummer extensions, cyclotomic extensions.

This course will focus a lot on solving exercises and giving plenty of examples. We will give several exercises to be done by students and will have weekly problem solving sessions where we will solve problems in detail.

ABOUT INSTRUCTOR :

Prof. Krishna Hanumanthu is an associate professor of mathematics at Chennai Mathematical Institute (CMI). He studied BSc and MSc in CMI during 1998-2003 and did his PhD in mathematics at University of Missouri during 2003-2008. He joined CMI as a faculty member in 2011 after working for 3 years at University of Kansas. His main areas of research are algebraic geometry and commutative algebra. He has been teaching for almost 15 years and taught introductory courses on abstract algebra (including group theory) many times

COURSE PLAN :

Week 1: Review of rings and fields I: polynomial rings, irreducibility criteria, algebraic elements, field extensions

Week 2: Review of rings and fields II: finite fields, splitting fields

Week 3: Normal extensions, separable extensions

Week 4: Fixed fields, Galois groups

Week 5: Galois extensions, properties and examples

Week 6: Fundamental theorem of Galois theory

Week 7: Solvability by radicals, insolvability of quintics

Week 8: Kummer extensions, abelian extensions, cyclotomic extensions