MATH0022 (Galois Theory)

Year:	2019–2020
Code:	MATH0022
Old code:	MATH3202
Level:	6 (UG)
Normal student group(s):	UG: Year 3 Mathematics degrees
Value:	15 credits (= 7.5 ECTS credits)
Term:	1
Structure:	4 hour lectures per week. Assessed coursework and mini-project
Assessment:	80% examination, 10% coursework, 10% project
Normal Pre-requisites:	MATH0053 (previously MATH7202)
Lecturer:	Dr ML Roberts

Course Description and Objectives

Galois theory is a very elegant piece of mathematics, bringing together ideas from group theory, ring theory and linear algebra. It can be used to solve classical geometric problems such as whether there is a construction for trisecting angles, using ruler and compasses. It can also be used to analyse the question of "solubility by radicals", i.e. the question of whether there are formulae (like the quadratic formula) for the solution of equations of higher degree than 2.

The course is based around a set book, Galois Theory by Ian Stewart. Considerable participation is expected from students: there will be collaborative work and exercises in class and 10 percent is assigned to a small group project towards the end of course, assessed by means of a short presentation. There is also a 10 percent coursework component. The normal prerequisites are a good grasp of basic linear algebra and some knowledge of group theory and a little ring theory. You also need to be reasonably happy dealing with fairly abstract algebraic ideas and reasonably complicated algebraic calculations. All the background needed is covered in Algebra 4.

Recommended Texts

The set book for the course is *Galois Theory* (3rd or 4th ed) by Ian Stewart (Chapman and Hall): it will be necessary to have a copy of this.

Detailed Syllabus

– Revision of ring theory: polynomials, Euclidean algorithm, unique factorization, etc.

– Prime subfield, characteristic, symmetric polynomials.

– Field extensions: degree, simple extensions, algebraic and finitely generate extensions.

– Splitting fields, normal extensions, normal closure.

– Galois group, Dedekind's Lemma.

– The fundamental Theorem of Galois theory.

– Soluble groups and their theory.

- Solution of equations by radicals.

Selected other topics may be covered, for example ruler and compass constructions, separability, finite fields.

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