1202 (Algebra 2)

Year:	2014–2015
Code:	MATH1202
Level:	First
Value:	Half unit (= 7.5 ECTS credits)
Term:	2
Structure:	3 hour lectures and 1 hour problem class per week. Weekly assessed coursework.
Assessment:	The final weighted mark for the module is given by: 90% examination, 10% coursework. In order to pass the module you must have at least 40% in both the examination and the final weighted mark.
Normal Pre-requisites:	MATH1201
Lecturer:	Dr ML Roberts
Problem class teacher:	Dr ML Roberts

Course Description

This course continues from 1201. It has two main components. The first is an introduction to the theory of groups; the idea of a group is central to much of algebra, and pervades many areas of mathematics. The second is a continuation of the study of linear algebra started in 1201; linear algebra underlies much advanced pure mathematics, as well as being an important tool in applications of mathematics. In particular, determinants are introduced, and the diagonalisation of matrices considered.

Recommended Texts

Two recommended books for this course are *A Guide to Linear Algebra* by Towers (MacMillan, paperback), and *Groups*, by Jordan & Jordan (Edward Arnold/Newnes, paperback). These are both quite helpful, elementary and not too expensive. There are of course many alternatives, in particular two other possible linear algebra books are *Elementary Linear Algebra* by Anton (Wiley, student edition) and *Linear Algebra* by Lang (Wiley, hardback). The first of these is a full, helpful and elementary text, a bit more expensive than the one by Towers; the second is more sophisticated than the others. You are not required to buy books for this course, although you may find it helpful to do so. If you do buy, please look at the books first to see if you find them suitable for you.

Detailed Syllabus

1. **Number Theory.** Primes. Euclids algorithm. The h, k-lemma. Unique factorization. Euclids theorem.
2. **Groups.** Definition, basic properties, order of an element. Subgroups, cyclic groups. Lagrange's Theorem and applications. Examples, including the symmetric group, symmetry groups of geometrical figures and modular arithmetic. Fermat's Little Theorem and the Chinese Remainder Theorem.
3. **Linear algebra.**

   (i) Brief revision of ideas of subspace, linear independence, linear span, basis and dimension.

(ii) Definition and examples of determinants. Properties, including proof that $\det(AB) = \det(A)\det(B)$. Calculations. Adjoint and inverse.

(iii) Eigenvalues and eigenvectors, characteristic equation, diagonalisation of matrices, applications. The Cayley-Hamilton Theorem.