School of Mathematics

Module MA1111 — Linear algebra I 2011-12
(JF Mathematics, JF Theoretical Physics & JF Two-subject Moderatorship)

Lecturer: Prof. P. Karageorgis

Requirements/prerequisites:

Duration: Michaelmas term, 11 weeks

Number of lectures per week: 3 lectures including tutorials per week

Assessment: Homework assignments will be due every Thursday. 20% homework, 80% final exam (based on homework and tutorials).

ECTS credits: 5

End-of-year Examination: 2 hour end of year examination.

Description: We will cover the following topics, yet not necessarily in the order listed.

- Lines, planes and vectors, dot and cross product.
- Linear systems, Gauss–Jordan elimination, reduced row echelon form.
- Matrix multiplication, elementary row operations, inverse matrix.
- Permutations, odd and even, determinants, transpose matrix.
- Minors, cofactors, adjoint matrix, inverse matrix, Cramer's rule.
- Vector spaces, linear independence and span, bases and dimension.
- Linear operators, matrix of a linear operator with respect to a basis.
- Change of basis, transition matrix, conjugate matrices.

Textbook We will not follow any particular textbook. Two typical references are

- *Algebra* by Michael Artin,
- *Basic linear algebra* by Blyth and Robertson.

Notes, homework assignments and solutions will be posted on the web page

`http://www.maths.tcd.ie/~pete/algebra1`

Learning Outcomes: On successful completion of this module, students will be able to:

- operate with vectors in dimensions 2 and 3, and apply vectors to solve basic geometric problems;

- apply various standard methods (Gauss–Jordan elimination, inverse matrices, Cramer's rule) to solve systems of simultaneous linear equations;
- compute the sign of a given permutation, and apply theorems from the course to compute determinants of square matrices;
- demonstrate that a system of vectors forms a basis of the given vector space, compute coordinates of given vectors relative to the given basis, and calculate the matrix of a linear operator relative to the given bases;
- give examples of sets where some of the defining properties of vectors, matrices, vector spaces, subspaces, and linear operators fail;
- identify the above linear algebra problems in various settings (e.g. in the case of the vector space of polynomials, or the vector space of matrices of given size), and apply methods of the course to solve those problems.

October 6, 2011