

**School of Mathematics****Course 464b - Numerical methods**

2006-07

(SS Theoretical Physics  
JS & SS Mathematics )

**Lecturer:** Dr. M. Peardon**Requirements/prerequisites:** 464a**Duration:** Second semester (10 weeks)**Number of lectures per week:** 3**Assessment:****End-of-year Examination:**

**Description:** This course, a continuation of course 464a, aims to give an introduction to solving problems in theoretical physics and related subjects using numerical methods. The emphasis is on practical solutions and implementations on the computer. Software will be developed during the course using the C programming language.

**Classical algorithms for numerical integration** Starting with the simplest Newton-Cotes rules, more advanced methods for solving integral problems in one-dimension are described such as Romberg integration. Gaussian quadrature is then described.

**Monte Carlo methods** The basic ideas needed to make stochastic estimations of integrals (and sums) is presented, with an emphasis on high-dimensional integrals. The Metropolis algorithm is described and applications are presented. The Ising model and thermodynamics of the Lennard-Jones potential are given as examples.

**Advanced algorithms for solving sparse linear systems** A few advanced techniques for solving large, sparse linear systems are defined. Conjugate gradient is described, as well as multi-grid acceleration and the fast fourier transform.

See <http://www.maths.tcd.ie/~mjp/464/> for additional details.

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