Registration begins April 9-13, 2012

EGGN 460/560: Numerical Methods for Engineers
3 credit hour

Technical elective in Civil, Electrical and Mechanical

TWR 4.00-6.05pm, May 11th - June 21st 2012, BB 125

Instructor: D.V. Griffiths

Office: BB 314F, Tel: 303 273 3669, Email: d.v.griffiths@Mines.EDU

Based on a textbook co-authored by the instructor ("Numerical Methods for Engineers", by D.V. Griffiths and I.M. Smith, CRC Press, 2006*), this course combines theory with practical programming experience, in which all students will be given a powerful suite of pre-written programs for solving a wide range of engineering problems. Students will be introduced to the numerical techniques needed to obtain solutions to problems which are either intractable analytically or too tedious to tackle by traditional "hand" techniques. Error analysis will be introduced where necessary, but the emphasis of the course will be directed towards obtaining solutions to the types of problems encountered by engineers in design, analysis and research.*

a Introduction and programming preliminaries: Philosophy of numerical analysis, programming languages, errors, introduction to course software. Discussion of the types of engineering problems which require solution by numerical methods.

b Linear algebraic equations (Chapter 2): Gaussian elimination, LU factorization, symmetry and banding, pivoting, iterative methods.

c Nonlinear equations (Chapter 3): Simple iteration, interpolation methods, extrapolation methods, systems of equations.

d Eigenvalue equations (Chapter 4): Orthogonality and normalization, direct and shifted iteration, the generalized eigenvalue problem, transformation methods, characteristic polynomial methods.

e Numerical integration (Chapter 6): Newton-Cotes rules, Gaussian rules, Special integration rules, multiple integrals.

f Ordinary differential equations (Chapter 7): Initial value problems, Runge-Kutta methods, systems of equations, θ-methods, predictor-corrector methods, boundary value problems.

g Interpolation and curve fitting (Chapter 5): Lagrangian polynomials, difference methods, numerical differentiation, least square methods.