School of Mathematics

Course 131 — Mathematical Methods   2004-05
(JF Mathematics, Theoretical Physics & Two-Subject Moderatorship)

Lecturer: Dr. J. Ó hÓgáin & Dr. F. Viniegra

Requirements/prerequisites: None

Duration: 22 weeks

Number of lectures per week: 3

Assessment:

End-of-year Examination: 3 hour paper in June

Description:
Linear algebra. General introduction to vectors and linear vector spaces, vectors in 3-dimensions, application to 3-dimensional geometrical problems. Euclidean spaces. The set of all real n-tuples, as an example of a linear vector space.

Matrices; motivation and definition. Algebra of matrices and multiplication of matrices. Elementary row and column operations. Gaussian elimination algorithm. Cofactor expansion of determinants. Invertibility of matrices and the formula for the inverse. Solution of a system of linear equations. Eigenvalues and eigenvectors of matrices, diagonalization of matrices. Determinants of square matrices, motivation, definition and main properties. Application to linear ordinary differential equations.

Linear independence and bases. Orthonormal bases.

Scalar and vector products, triple scalar and triple vector products and geometrical interpretations.
Multivariable calculus. Review of calculus in 1-dimension, introduction to partial differentiation, gradient operator and its geometrical significance. Taylor polynomials, Taylor series. Maxima and minima (extreme values), local and absolute. Critical points, 1st and 2nd derivative tests. Extreme values subject to constraints, Lagrange multipliers. Multiple and iterate integrals, line, surface and volume integrals, change of variable, Jacobians.
First order differential equations.   Separable and homogeneous equations. Integrating factors.

Additional information can be found at `http://www.maths.tcd.ie/~viniegra/131/Program/Program131.html`
References

1. G. H. Thomas Jr and R. L. Finney : Calculus and Analytic Geometry

2. Howard Anton and Chris Rorres, Elementary Linear Algebra applications version, (7th edition) Wiley 1994.

3. W. E. Boyce & R. C. DiPrima, *Elementary Differential Equations*, John Wiley.

June 25, 2004