

# Numerical Analysis Q Exam Syllabus 2005

## Accuracy, stability and conditioning

KMN 2.1-2.2 or H 1.2-1.3

## Linear Algebra

|  |                                    |
|--|------------------------------------|
| Norms & condition numbers                      | GVL3 2.2, 2.3, 2.7 or H 2.3        |
| Gaussian elimination                           | GVL3 3.1,3.2,3.4 or H 2.4          |
| Cholesky and LDL <sup>T</sup> factorization    | GVL3 4.1,4.2 or H 2.5.1            |
| Symmetric eigenvalue problem &<br>Power method | GVL3 8.1, 8.2 or H 4.2, 4.4, 4.5.1 |
| Singular Value Decomposition (SVD)             | GVL3 2.3, 6.5 or H 3.6             |

## Optimization

|   |                                   |
|---|-----------------------------------|
| Least squares, normal eqs &<br>QR factorization | GVL3 5.1,5.2,5.3 or H 3.1-3.5     |
| Newton's method (nonlinear equations)           | DS 2.2,2.4,5.1,5.2 or H 5.5,5.6.2 |
| Newton's method (optimization)                  | DS 5.5 or H 6.4.3, 6.5.3          |

## Initial Value Problems

|  |                                      |
|--|--------------------------------------|
| Basic theory                                     | H 9.1 or KMN 8.1                     |
| Forward & backward Euler,<br>stability and order | KMN 8.4,8.5,8.8 or H 9.2,9.3.1-9.3.4 |

Comments: Where several texts are listed, you need to read only one, but you also must understand the principles underlying the material (which are usually facts from linear algebra or calculus). GVL3, DS and KMN are often more in-depth than H.

## References

[DS] J. E. Dennis and R. B. Schnabel, *Numerical Methods for Unconstrained Optimization and Nonlinear Equations*, Prentice Hall, 1983.

[GVL3] G. Golub and C. Van Loan, *Matrix Computations*, 3<sup>rd</sup> Ed., Johns Hopkins Univ. Press, 1996. (Note that earlier editions also cover the syllabus material but some sections are numbered differently.)

[H] M. Heath, *Scientific Computing: An Introductory Survey* 2<sup>nd</sup> Ed, McGraw Hill, 2002. (Note that the first edition also covers the syllabus material but some sections are numbered differently.)

[KMN] D. Kahaner, C. Moler and S. Nash, *Numerical Methods and Software*, Prentice Hall, 1989.