Mathematical Methods for Computing

a series of courses 1984 - 85

HARWELL
Education Centre

To All Receiving This Leaflet

We are attempting to rationalise our advertising. This will be the last year you will automatically receive this leaflet. If you wish to receive future copies, please complete the pre-paid card.

Mathematical Methods for Computing

A series of seven short courses on mathematical methods for computing intended for people who are graduates, who have a knowledge of mathematics of at least A level standard and who wish to compute numerical solutions to problems. Anyone who attends should have some programming experience.

The courses describe, compare and criticise numerical methods for mathematical calculations; special attention is given to the general pupose methods that are available as subroutines in the Harwell library. (These subroutines are now generally available and students from outside Harwell can obtain copies on request.) Therefore they inform computer users of the kind of mathematical problems that can be solved automatically and help them to choose suitable algorithms for their calculations. Moreover they provide an opportunity for discussion among users and lecturers who have an interest in similar problems.

Most students should regard the earlier courses as helpful to the later ones. The first course provides a theoretical and practical introduction that is relevant to all the later courses for students who need an elementary introduction to numerical work. Familiarity with matrices in a numerical setting is needed in the last five courses. For those without such familiarity we recommend prior attendance at the matrix course. Similarly we recommend attendance at the ordinary differential equations course prior to attendance at the partial differential equations course.

Numerical exercises are mentioned in the previous paragraph because all the courses include practical classes, for the solution and discussion of problems that are chosen to reinforce the main points of the lectures. We recommend students to bring hand calculators.

1 Elementary Numerical Techniques (2½ days)

10 to 12 September 1984 **Fee £240 + VAT**

Principal Lecturer: Mr C. R. Kirby

Some elementary numerical methods are explained, not only because they are useful, but also to contrast the nature of numerical computation with conventional mathematics. A feature of this course is a strong bias towards numerical examples to explain the principles and to make each student conversant with numerical techniques.

Five main topics are considered. They are (1) the origin, propagation and control of errors, (2) iteration and the acceleration of convergence, (3) iterative methods for solving a non-linear equation, (4) introduction to finite differences including interpolation and numerical differentiation and (5) numerical integration. Some time is spent on describing the facilities that are available in the Harwell subroutine library.

2 *Numerical Calculations with Matrices (3 days)*

29 to 31 October 1984 **Fee £285 + VAT**

Principal Lecturer: Dr I. S. Duff

Reviews matrices and their properties and describes methods for solving linear equations and for the calculations of eigenvalues and eigenvectors of matrices. Consideration is given to the numerical difficulties that may occur in practice and possible ways of avoiding loss of accuracy are suggested. Some matrices have features that are very useful in practice, for example symmetry, band structure and sparsity and these are studied. Special attention is given to the methods used by the programs in the subroutine library. Students should obtain some experience with elementary matrix calculations before attending.

3 *Data Fitting and Approximation (3 days)*

10 to 12 December 1984 **Fee £285 + VAT**

Principal Lecturer: Mr A. R. Curtis

Intended to give guidance on the advantages and disadvantages of different kinds of approximating functions, including polynomials, rational functions and piecewise polynomials (splines), to discuss criteria for comparing the quality of different approximations and to describe methods for computing approximations, emphasizing the methods that are available in the subroutine library. Sometimes the function to be approximated is a definite mathematical function and at other times one has only some discrete function values, which are often measurements that include experimental errors. The differences between these two cases are studied.

4 *Optimization and Non-Linear Least Squares Calculations (3 days)*

This course will not be run in the 1984/5 academic year. It is being extensively revised and will be offered again in 1985/6.

5 Numerical Solution of Ordinary Differential Equations (3 days)

18 to 20 February 1985 **Fee £285 +VAT**

Principal Lecturer: Mr A. R. Curtis

Gives an introduction to modern methods for solving ordinary differential equations numerically, including methods that are suitable for stiff systems. The student obtains some familiarity with the techniques and problems involved and is given guidance upon the available software for both initial and boundary value problems. He should have some acquaintance with differential equations, vectors and matrices and also some programming experience, preferably in FORTRAN.

On completion of the course the participant has solved real problems in ordinary differential equations and should be in a position to select from the algorithms offered to him.

6 Applied Statistics (3 days)

18 to 20 March 1985 **Fee £285 + VAT**

Principal Lecturer: Dr J. K. Reid

The aim is to provide the student with a firm grasp of statistical concepts and to give a general introduction to the basic techniques of applied statistics. The level of presentation is elementary, but mathematical derivations are given when this is essential to the understanding of a topic, and mathematical sophistication of at least A level standard is assumed. Subjects covered include probability theory, sampling distributions, estimation and significance tests. Applications include simple regression, correlation, multiple repression, experimental design, analysis of variance and analysis of counts.

7 Partial Differential Equations (3 days)

20 to 22 May 1985 **Fee £285 + VAT**

Principal Lecturer: Dr I. P. Jones

Describes and compares various numerical methods for solving partial differential equations. Both stationary (elliptic) and time-dependent (parabolic and hyperbolic) problems are considered. Participants should have a knowledge of algorithms for ordinary differential equations.

Finite difference, finite element and variational methods are described. Subroutine library facilities which are helpful when writing programs for such problems are included.

Before attending please ensure that you have a letter of acceptance from this Centre

APPLICATION

To:– The EDUCATION & TRAINING CENTRE,
A.E.R.E. HARWELL, OXFORDSHIRE. OX11 0QJ

Telephone (STD 0235) 24141. extn. 2350 or 2140

For office use only

Please reserve a place for me on

Surname (Dr/Mr/Mrs/Miss)	Other names	Nationality	Date and place of birth

Academic qualifications	Home address Tel. no.	Employer's name and address Tel. no.

Nature of present work in relation to the subject of the course	Correspondence should be sent to employer's address/home address Signature of applicant Date

A remittance for £ for the course fee, made payable to the 'UKAEA Harwell', should accompany this form, with the addition of Value Added Tax.

V.A.T. Registration No. 239 0768 41