Applied Mathematics

Learning Outcomes

At the end of this course the student will be capable of gained the ability to:

1. explain how differential equations arise in the context of physical applied mathematics
2. apply elementary concepts in continuum mechanics to derive equations
3. formulate and solve some initial and boundary value problems for partial differential equations
4. use simple computer-based techniques for solving analytical problems by numerical methods
5. use a mathematical computer package to solve problems and then write a report explaining the analysis

Syllabus

- Introduction to mathematical modelling: Newton's laws of Motion, Dimensionless analysis
- Introduction to Partial Differential Equations, PDE's.
- Conservation Laws.
- First Order PDE's: Method of characteristics, Initial value problems.
- Linear Second Order PDE'S: Derivation of the wave and heat equations, Chemical reactions, d'Alembert's solution, Separation of variables.
- Numerical Solution of Differential Equations: First order initial value problems, Systems of equations, Second order problems initial value problems, Second order boundary value problems.
- Polynomial Approximation: Taylor polynomials, Lagrange polynomials, data fitting.
- Root Finding: Fixed point iterations, Newton method, rates of convergence.
- Numerical Integration: Simpson's rule, Gaussian quadrature.

Suggested Reading

For an introduction to conservation laws and partial differential equations *Fields, Flows and Waves: An introduction to continuum models* by D. F. Parker (SUMS series). For numerical schemes and methods *Guide to scientific computing*, by P. R. Turner.

Teaching

Lecturer	Dr D. A. Kay	room Man 2A14
Office Hours	10am Monday	room Man 2A14
	10am Tuesday	room Man 2A14
Lecture	11-1 Monday	room Pev1 1A6
Lecture	11-1 Tuesday	room Pev1 1A6

Plus workshops.

Assessment

10 Worksheets 10%. Group project 15%. Unseen Exam 75%.