MANCHESTER 1824
The University of Manchester

This is archived information. Please visit http://www.maths.manchester.ac.uk for current course unit information

MATH36022

Numerical Analysis II

Unit code:	MATH36022
Credit Rating:	10
Unit level:	Level 3
Teaching period(s):	Semester 2
Offered by	School of Mathematics
Available as a free choice unit?:	N

Requisites

Prerequisite

- MATH20602 - Numerical Analysis 1 (Compulsory)

Additional Requirements

MATH36022 pre-requisites

Aims

To introduce students to theoretical and practical aspects of best approximation, quadrature, and the numerical solution of ordinary differential equations.

Overview

This module introduces numerical methods for approximating functions and data, evaluating integrals and solving ordinary differential equations. It continues the introduction to numerical analysis begun in MATH20602. It provides theoretical analysis of the problems along with algorithms for their solution. Insight into the algorithms will be given through MATLAB illustrations, but the course does not require any programming.

Assessment methods

- Other - 20%
- Written exam - 80%

Assessment Further Information

- Mid-semester test: weighting 20%
- End of semester examination: two hours weighting 80%

Learning outcomes

On completion of the module, students will be familiar with

- the theory of best approximation and how to compute best polynomial approximations in the 2- and â'ž-norms,
- the theory and practice of numerical integration,
- the theory and practice of numerical methods for solving ordinary differential equations.

They will also recognize some of the difficulties that can occur in the numerical solution of problems arising in science and engineering.

Future topics requiring this course unit

None.

Syllabus

1.Approximation and Curve Fitting. Best approximation in the 1-norm. Weierstrass theorem, equioscillation theorem, Chebyshev polynomials. Best approximation in the 2-norm. Orthogonal polynomials. Rational approximation; Pad approximants. [6]

2.Numerical Integration Interpolatory rules. The Romberg scheme: extrapolation using the Euler-Maclaurin summation formula. Gaussian quadrature. Adaptive quadrature. [6]

3.Initial Value Problems for ODEs Introduction and existence theorem. Numerical methods: one step methods and multistep methods. Eulers method. Local truncation error, convergence, local error. Taylor series method. Runge-Kutta methods. Trapezium rule. Functional iteration and predictor-corrector PE(CE)m implementations. Absolute stability. Linear multistep methods. Higher order systems. [10]

Recommended reading

1.Endre Sli and David F. Mayers. An Introduction to Numerical Analysis. Cambridge University Press, Cambridge, UK, 2003. ISBN 0-521-00794-1. x+433 pp.

2.Richard L. Burden and J. Douglas Faires. Numerical Analysis. Brooks/Cole, Pacific Grove, CA, USA, seventh edition, 2001. ISBN 0-534-38216-9. xiii+841 pp.

3.James L. Buchanan and Peter R. Turner. Numerical Methods and Analysis. McGraw-Hill, New York, 1992. ISBN 0-07-008717-2, 0-07-112922-7 (international paperback edition). xv+751 pp.

4.David Kincaid and Ward Cheney. Numerical Analysis: Mathematics of Scientific Computing. Brooks/Cole, Pacific Grove, CA, USA, third edition, 2002. ISBN 0-534-38905-8. xiv+788 pp.

5.David Nelson, editor. The Penguin Dictionary of Mathematics. Penguin, London, fourth edition, 2008. ISBN 978-0-141-03023-4. 480 pp.

Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and provide feedback on their understanding.

Study hours

- Lectures - 22 hours
- Tutorials - 11 hours
- Independent study hours - 67 hours

Teaching staff

Catherine Powell - Unit coordinator