



COURSE: Numerical Analysis

TEACHER: Concetta Laurita

e-mail: concetta.laurita@unibas.it

website:

Language: Italian

ECTS: 6

n. of hours: 54

Academic year: 2015/16

Campus: Potenza

Semester: I

TOPICS

Errors and computer arithmetic.

Numerical methods for the solution of linear system.

Numerical methods for the solution of nonlinear equations.

Approximation of functions.

Numerical integration.

Numerical differentiation.

Numerical methods for the solution of ODE.

TEACHING METHODS (please tick one or more options)

Theoretical lessons

Tutorials in classroom

Tutorials in laboratory

Project works

Technical visits

Other activities (please specify) _____

TEXTBOOKS

G. Monegato, Fondamenti di Calcolo Numerico, CLUT (Torino)

A. Quarteroni, R. Sacco, F. Saleri, Matematica Numerica, Springer

ON-LINE EDUCATIONAL MATERIAL

web address:

LEARNING OUTCOMES

To know the main numerical methods applied in different contexts. To be able to choose between antagonists methods for solving a specific problem (eg, comparing the order of convergence, stability of algorithms, computational cost). To achieve a good level in programming algorithms, for example, in Matlab, in order to apply the studied numerical methods. To be able to read the numerical results provided by the machine.

REQUIREMENTS

The knowledge of the arguments from Calculus and Linear Algebra, basics of computer science and Matlab programming fundamentals.

EVALUATION METHODS (please tick one or more options)

Intermediate verifications

Written examination

Discussion of a project work

Practical test

Oral examination

Other methods (please specify) _____



DETAILED CONTENT

Errors and computer arithmetic

Single and double precision. Absolute and relative error. Machine precision. Conditioning of a problem and algorithm stability. Numerical cancellation.

Numerical methods for linear systems

Condition number. Back and forward substitution. Gauss elimination, pivoting. LU factorization. Cholesky factorization. Iterative methods: Jacobi and Gauss-Seidel methods with convergence study.

Numerical methods for the solution of nonlinear equations

Bisection method. Newton method.

Approximation of functions

Algebraic polynomial approximation by Lagrange interpolation. Interpolation by piecewise polynomial functions. Spline functions.

Numerical integration

Quadrature formulas. Stability, convergence, degree of accuracy, error estimation. Newton-Cotes quadrature rules. The trigonometric quadrature formula.

Numerical differentiation

Finite difference methods.

Numerical methods for the solution of ODE

The Initial Value Problem. Onestep and multistep methods. Runge-Kutta methods. Predictor-corrector methods.

Practical implementation of the studied algorithms in Matlab.

SEMINARS BY EXTERNAL EXPERTS YES NOX

FURTHER INFORMATION
