UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
BACHELOR'S DEGREE (BSC)	COMPUTER ENGINEERING
SUBJECT	MATHEMATICAL AND NUMERICAL METHODS
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50283-Matematica, informatica e statistica
CODE	20310
SCIENTIFIC SECTOR(S)	MAT/08
HEAD PROFESSOR(S)	FRANCOMANO ELISA Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**FRANCOMANO ELISA** Tuesday 09:00 11:00 Ed.6- Stanza 2

DOCENTE: Prof.ssa ELISA FRANCOMANO

PREREQUISITES	To be successful in the course, a good background in geometry, calculus is required. Given the computational nature of the course a basic programming experience is also required.
LEARNING OUTCOMES	Knowledge and Understanding At the end of the course the student will gain knowledge on the numerical and mathematical methodologies in the applied science, will be able to identify the mathematical and discrete modelling of the problem, to characterize efficient methods in problem solving and to define logical schemes for the automatic execution. The student will able to adopt the numerical tools for the error analysis, the solution of linear systems and definite integrals, approximation of functions; will be able to discern the well-conditioned of a problem, the numerical stability of the algorithm and the computational complexity. The student will be able to define and formulate efficient algorithms, to choose among the various methodologies the most suitable for the problem in use and to explain the computational results and the mathematical solver adopted. Moreover, the student will be able to design computational schemes and codes for various problems of the applied sciences. Written and oral tests to assess the knowledge of the subjects.
ASSESSMENT METHODS	Written and oral tests. Grades are awarded on a scale from 18 to 30. The written test concerns the proposed contents provided during the course. The oral examination can be accessed if the written test is passed with a grade equal or more than 18/30. The final grade will be based on the following evaluation criteria: 40%: written test: assessment of the computational tools employed in the problem solving and evaluation of the final results. 40% oral test : knowledge and understanding of the methodologies and algorithms covered in the course. 20%: technical language and expertises, mathematical accuracy and logical-deductive skills.
EDUCATIONAL OBJECTIVES	The student will gain the mathematical foundations of well-established numerical algorithms and will be able to adopt it for a wide range of scientific and engineering disciplines. The student will be able to discuss about the methodology and algorithms adopted in relation to the theory covered in the course and to critically think on the results obtained with the own software.
TEACHING METHODS	Lecturers in class and class work.
SUGGESTED BIBLIOGRAPHY	Materiale didattico fornito dal docente. Metodi e algoritmi per il calcolo numerico-Giovanni Monegato-CLUT EAN: 9788879924672-ISBN: 8879924672 S.C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill

SYLLABUS

Hrs	Frontal teaching
5	The role of numerical methods in engineering problem solving. Floating point arithmetic. Truncation and round-off errors. Error propagation. Conditioning and numerical stability. Computational complexity.
10	Data fitting. Difference operators. Numerical differentiation. Composite interpolation. Spline functions. Algorithms and implementation skills of the proposed numerical methods.
8	Least square regression. Polynomial regression. Orthogonal polynomials. Fourier approximation. Fourier series. Discrete Fourier transform. Fast Fourier Transform. Algorithms and implementation skills of the proposed numerical methods.
6	Numerical integration. Nodes and weights. Error estimates. Accuracy. Quadrature formulas. Algorithms and implementation skills of the proposed numerical methods.
15	Linear algebraic equations: direct and iterative methods. Eingevalues and eigenvectors. Eingevalues localization methods. Algorithms and implementation skills of the proposed numerical methods.
5	Ordinary differential equations. Linear ordinary differential equations. Differential equations with separable variables, omogeneous and non omogeneous.

Hrs	Practice
32	Exercises, algorithms and implementation skills of the proposed numerical and mathematical methods. Case studies referred to engineering applications. Discussion of the final results.