Syllabus Attività Formativa

Anno Offerta	2021
Corso di Studio	B35 - PHYSICS
Regolamento Didattico	B35-20-21
Percorso di Studio	CGE - GENERALE
Insegnamento/Modulo	A423183 - COMPUTATIONAL METHODS FOR PHYSISCS - COMPUTATIONAL METHODS FOR PHYSISCS
Attività Formativa Integrata	-
Partizione Studenti	-
Periodo Didattico	S2 - Secondo Semestre
Sede	
Anno Corso	1
Settore	FIS/04 - FISICA NUCLEARE E SUBNUCLEARE
Tipo attività Formativa	B - Caratterizzante
Ambito	50340 - Microfisico e della struttura della materia
CFU	8.0
Ore Attività Frontali	76.0
AF_ID	170099

Tipo Testo	Codice Tipo Testo	Num. Max. Caratteri	Obbl.	Testo in Italiano	Testo in Inglese
Lingua	LINGUA_INS	100	Sì	Inglese	English

insegnamento					
Contenuti	CONTENUTI	2000	Sì		An introduction to numerical methods which are used in solving problems in physics, including solutions of differential equations, matrix operations and eigenvalue problems, interpolation and numerical integration, modeling of data and Monte Carlo methods.
Testi di riferimento	TESTI_RIF		Sì		General reference books: Computational Physics - Problem Solving with Computers R. H. Landau, M. J. Páez, and C. C. Bordeianu WILEY Computational Physics P.O.J. Scherer Springer Computational Physics – Lecture Notes Fall 2015 M. Hjorth-Jensen University of Oslo
Obiettivi formativi	OBIETT_FORM	3000	Sì		The student will develop a familiarity with some of the most used algorithms in Physics. Several examples of problems

					in physics will be used in order to demonstrate various numerical methods. The examples span over several fields. The course is project based and through the various projects, normally five, the participants will be exposed to fundamental research problems in these fields. The students will learn to develop and structure codes for studying these systems, develop a critical understanding of the capabilities and limits of the various numerical methods, get acquainted with supercomputing facilities and parallel computing and learn to handle scientific projects.
Prerequisiti	PREREQ	2000	Sì		The basic knowledge of one of the following computing languages: C/C++, Python, Fortran
Metodi didattici	METODI_DID	2000	Sì		The course is offered for one semester and comprises 40 hours of lectures, in addition to 36 hours of laboratory exercises aided by the use of a computer. The course will also include five projects that students will receive feedback on. Attendance is not compulsory but strongly recommended.

Altre informazioni	ALTRO	2000	Sì		
Modalità di verifica dell'apprendimento	MOD_VER_APPR	3000	Sì		Specific knowledge will be verified in the oral exams with questions starting from the projects realized and presented by the students.
Programma esteso	PROGR_EST		Sì		1) Errors and Uncertainties in Computations 2) Numerical differentiation and interpolation . 3) Non-linear Equations 4) Numerical Integration 5) Linear algebra and eigenvalue problems • Gaussian elimination and LU decomposition • How to solve linear equations • How to obtain the inverse and the determinant of a real symmetric matrix • Iterative solvers • Cubic spline • Tridiagonal matrix decomposition • Householder’s tridiagonalization technique and finding eigenvalues basedon this • Jacobi’s method for finding eigenvalues

					6) Ordinary differential equations • Euler's method and improved Euler's method, truncation errors • Runge Kutta methods, 2nd and 4th order, truncation errors • Verlet algorithm 7) Partial differential equations • Diffusion equation • Laplace's and Poisson's Equations • Wave Equation in two Dimensions 8) Monte Carlo methods in physics • Random walks and Markov chains • Metropolis algorithm • Applications to statistical physics systems • Monte Carlo sampling