Basic/Essential Course Information	
Course title	Kinetic theory of transport phenomena
Degree Course title	Physics
ECTS	6
Compulsory attendance	Yes
Course teaching language	English

Teacher	Savino Longo	savino.longo@uniba.it

ECTS Details	Disciplinary area/broad field:	SSD	ECTS
	Characterizing	CHIM/03	6

Time management and teaching activity type	Period	Year	lesson type
	2st semester	1rd	Lessons (40h) Laboratory (15h)

Time management,	Total hours	in-class/in-lab study hours	out-of-class study hours
	150	55	95

Course calendar	Starting date	Ending date
	7.03.2023	25.05.2023

Syllabus	
Prerequisites	Basic chemistry. Differential equations. Basic computer programming.
Expected learning outcomes (according to Dublin Descriptors)	**Knowledge and understanding:** The use of the concepts of transport theory to the understanding of physical, astrophysical and astrochemical systems. **Knowledge and understanding skills applied:** The students learn how to use powerful mathematical technique developed for transport problems but applicable to many other fields. The students also learn how to develop, check and use computer programs to solve specific problems. **Judging autonomy:** Students are encouraged to choose personal solutions to the problems they are facing, and sufficiently elaborate solutions can be the essential part of the exam interview. **Communicative Skills:** Know how to expose the particularities of case studies and propose solution techniques, discussion in the classroom is encouraged **Learning Skills:** Know how to extract operational information for case

	studies from formal texts
Course contents summary	The course teaches to apply the concepts and methods of transport phenomena starting from diffusion theory and elementary kinetic theory to arrive at the most advanced formulations, which find application for example in astrophysics and nuclear energy. It is taught to formulate and solve problems in integral-differential, integral form and using special functions and computer calculations. Advanced mathematical techniques, also useful in various fields of physics, chemistry, and biology, are taught through practice and application rather than by proving theorems.
detailed syllabus	Brownian motion and potential theory. Numerical solutions of the steady-state diffusion equation. Boundary conditions. Green functions. Deterministic and Monte Carlo calculations of integrals. The transport equation in integral-differential form. Isotropic and anisotropic scattering. Integral formulations: the Schwarzschild-Milne equation. Properties and uses of Chandrasekhar's function. Monte Carlo method applied to transport problems. Charged particles dynamics and transport: linear and nonlinear. Applications: photon transport in planetary atmospheres, electron and ion transport in plasmas, nuclear reactors.
books	1. Chandrasekhar, *Radiative Transfer*. 2. Dupree, S. A., & Fraley, S. K. (2012). *A Monte Carlo primer: A Practical approach to radiation transport.*
notes	Some chapters of each. Scientific papers are used for special methods and applications.
Teaching methods	Lessons with proposal and discussion of cases of study. Development of computational codes.
Assessment % of final mark	Results and methodology of the final presentation (50%) presentation and discussion (50%)
Evaluation criteria	the student • **knows** the principles of transport theory and its application to real problems • **knows** how to develop method to solve transport equations • **knows** how to use sound simplification and hypothesis for concrete cases. • **knows how to realize** a presentation. • **knows how to present** the results
other	