COURSE OF STUDY *Fisica (L-30)*

ACADEMIC YEAR *2023-2024*

ACADEMIC SUBJECT *Metodologie fisiche per l'ambiente (Physical methods for environmental science)*

General information	
Year of the course	III year
Academic calendar (starting and ending date)	II semester (03-24 al 06-24)
Credits (CFU/ECTS):	4
SSD	FIS03-FIS07
Language	Italian
Mode of attendance	Not compulsory

Professor/ Lecturer	
Name and Surname	Pietro Patimisco
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Department and address	Physics Department, via Amendola 173
Virtual room	*xxxxxxxx*
Office Hours (and modalities: e.g., by appointment, on line, etc.)	Monday, 15:00 – 17:00; Wednesday, 16:00 – 18:00

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
100	32		68
CFU/ECTS			
4	4		

Learning Objectives	The course aims to provide an in-depth preparation in the analysis of the natural environment. Specifically, the learning objectives are: ● provide fundamental knowledge and concepts on the vertical structure of the atmosphere, the Earth-Atmosphere Energy Balance, pollutant dispersion in atmosphere, and optical phenomena in the atmosphere; ● offer a basic understanding of the physical processes governing the atmosphere, with particular emphasis on phenomena occurring near the Earth's surface, in both natural and anthropogenic environments.
Course prerequisites	Basic knowledge of mathematics and classical physics

Teaching strategies	
Expected learning outcomes in terms of	
Knowledge and understanding on:	o Acquire the knowledge regarding physical models for describing the environment. o Ability to correctly interpret texts and graphics in documents reporting on processes governing the environment.

Applying knowledge and understanding on:	o Ability to apply the knowledge acquired during the course to solve problems, with specific reference to issues related to the environment.
Soft skills	• *Making informed judgments and choices* o Understanding of the basic concepts necessary to provide a contribution on environmental topics that require scientific knowledge. o Development of critical and quantitative analysis skills to provide prompt evaluations of pseudo-quantitative public information. • *Communicating knowledge and understanding* o Development of competencies for written and oral communication on topics related to the environment • *Capacities to continue learning* o Keep up with current advances and further perspectives on climate and environmental protection issues. o Evaluate the reliability of theoretical problems encountered in the dissemination of environmental topics.
Syllabus	
Content knowledge	**Vertical Structure of the Atmosphere.** Hydrostatic equation. Dry adiabat. Saturated adiabat. Cloud formation. **Radiation Balance in the Atmosphere:** Emission spectra and absorption spectra. Blackbody emission. Lambert-Beer law. Radiation balance. Earth's surface temperature. Solar emission spectrum. Infrared emission of the Earth's surface. **Simple Changes in the Radiation Balance.** Radiation Transfer. A Simple analytical model. Radiative forcing and global warming. Time delay by ocean warming. The greenhouse gases. Global Warming Power. **Dynamics in the Climate System.** Horizontal Motion of Air. Pressure gradient forces, viscous forces, gravity, and Coriolis force. Geostrophic flow. Natural climate variability. Human-Induced climate change. Structure of climate modeling. Modelling the atmosphere. **Dispersion of Pollutants in Atmosphere.** Diffusion equation. Instantaneous plane source in three dimensions. A finite-size cloud. Continuous point source in three dimensions. Point source in three dimensions in uniform wind.
Texts and readings	E. Boeker and R. van Grondelle – Environmental Physics: Sustainable Energy and Climate Change, Wiley.
Notes, additional materials	Selected chapters
Repository	Slides are available at the following website: http://polysense.poliba.it/index.php/metodologie-fisiche-per-lambiente/

Assessment	
Assessment methods	
Assessment criteria	• *Knowledge and understanding* o Knowledge of the properties of the Earth-atmosphere system o Understanding of the energy balance mechanisms among the Earth, the Sun, and the atmospherex • *Applying knowledge and understanding* o Ability to use acquired knowledge to quantitatively explain physical phenomena • *Autonomy of judgment* o Critical ability to select appropriate physical models to interpret phenomena involving the Earth's atmosphere • *Communicating knowledge and understanding*

	o Clear presentation of a physical phenomenon related to climate and environmental protection topics ● *Communication skills* o Ability to use fundamental concepts of physics to explain physical phenomena related to the interaction between the Earth and the atmosphere, based on natural and anthropogenic activities
Final exam and grading criteria	The oral exam will consist of two questions selected from the topics covered during the lectures.
Further information	