COURSE: Environmental and Atmospheric Physics			
CADEMIC YEAR: 2018-2019			
TYPE OF EDUCATIONAL ACTIVITY: (Basic, Characterizing, Affine, Free choice, Other) Affine			
PROFESSOR: Paolo Di Girolamo			
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Language: Italian			
ECTS: (lessons e tutorials/practice) 9	n. of hours: (lessons e tutorials/practice)81	Campus: Potenza School of Engeneering Program: CdLM-IAT	Semester: II

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This course is the only one within this Program dedicated to Environmental and Atmospheric Physics and examines the basic elements of these disciplines.

The main objective of the course is to provide the students with the basic information to face the study of meteorology and climatology.

The primary stock of knowledge provided by the course includes the fundamentals of environmental and atmospheric physics. More specifically, faced topics include:

Atmospheric composition and its variability with height, thermal structure of the atmosphere, air pollution, dry and wet atmospheric thermodynamics, atmospheric stability, atmospheric spectroscopy, radiation-matter interaction, absorption and emission in the atmosphere, Rayleigh and Mie scattering, atmospheric photochemistry, radiative transfer, cloud physics, atmospheric dynamics, atmospheric waves and turbulence, remote sensing techniques, radiometers, radar, sodar, Rass, GPS and lidar.

The primary skills acquired by the students during the course will be represented by the capability to analyze environmental and atmospheric physics problems and determine possible solutions for them.

The knowledge gained in this course will help in consolidating the student's understanding of the principles of Environment and Territory Engineering, specifically in the field of air pollution and prevention of hydrological and hydraulic risks, with the primary objective of gaining a specialized engineering training for the purposes of environmental protection and pollution control.

PRE-REQUIREMENTS

It is highly desired that students attending this course have previously attended and gone through the final examinations of the courses of Mathematical Analysis I and II, Geometry, Physics I and II, Mathematical Physics.

SYLLABUS

The disciplines of atmospheric physics, introductory elements on the terrestrial atmosphere, atmospheric composition and its variability with height, vertical profiles of pressure and density, molecular diffusion and turbulent motion, mean characteristics of the terrestrial atmosphere, charged particles in the atmosphere, ionosphere, magnetosphere, origin of the atmosphere, thermal structure of the atmosphere, climatological variability of atmospheric temperature, units to quantify atmospheric concentration, water vapour, carbon dioxide and ozone, aerosol, minor atmospheric constituents and air pollution, atmospheric thermodynamics, ipsometric equations, scale height, first thermodynamic law, specific heat, latent heat, potential temperature, adiabatic lapse rate, water vapour in the atmosphere, mixing ratio, saturation vapour pressure, saturation mixing ratio, relative humidity, dew point and freezing point, Lifting condensation level, saturation adiabatic lapse rate, pseudo-adiabatic process, equivalent potential temperature, irreversible condensation processes, atmospheric stability, Clausius-

Clapeyron equation. Atmospheric spectroscopy, radiation-matter interaction, absorption, emission and scattering in the atmosphere, selection rules, electronic, vibrational and rotational levels of molecules, Reileigh and Mie scattering, atmospheric photochemistry, radiative transfer, radiometric quantities, radiant flux, radiance and irradiance, black-body radiation, Stefan-Boltzmann law. Kirchhoff's law. Selective absorbers and emitters. Beer's law. The vertical profile of absorption. Schwarzchield's equation. Radiative transfer equations in the presence of clouds. Cloud physics. Atmospheric aerosols. Origin of atmospheric aerosols: sources and sinks, size distributions, Nucleation, Kelvin's formula, homogeneous and heterogeneous nucleation, cloud condensation nuclei, warm cloud microphysics: condensation, collision and coalescence, cold cloud microphysics: aggregation and riming, Atmospheric dynamics, Motion equation and its form in a rotating system, Lagrangian and Eulerian derivative, Coriolis's acceleration, Scale analysis, The geostrophic approximation, The hydrostatic approximation, Cyclostrophic motion, Rossby's number, Thermal wind equation, Continuity equation, Barotropic and baroclinic atmosphere, atmospheric waves and turbulence, Primitive equations, Acoustic waves, Gravity waves, Lee waves, Rossby waves, Vorticity equation, Remote sensing techniques, radiometers, radar, sodar, Rass, GPS and lidar (elastic, Raman ed differential absorption).

TEACHING METHODS
Theoretical lessons.

EVALUATION METHODS
Intermediate oral verifications, Oral examination.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL
Murry L. Salby, Fundamentals of Atmospheric Physics, Vol. 61, Academic Press, 1996.
John M. Wallace, Peter V. Hobbs, Atmospheric Science: An Introductory Survey, Academic Press 1977.
Copy of slides for a portion of the program.

INTERACTION WITH STUDENTS
During the introductory lecture, after describing the educational goals of the course, the program and the evaluation methods, the Professor provides the students with part of the didactic material (copy of slides for part of the program). During this introductory lecture, the Professor also files the list of students attending the course, including first and last name, matriculation number, email address and mobile phone number for each student. The Professor provides the students with his email address and mobile phone number to be used by the students both to directly request information and clarifications and to define the date for a possible meeting.

Receiving hours: Wednesday from 15:00 to 16:00 and Thursday from 15:00 to 16:00 in the Professor office, i.e. room 33 ter, fifth floor, Engineering School Building. Besides the receiving hours, the Professor is continuously available to the students through emails and mobile phone.

EXAMINATION SESSIONS (EXPECTED)[1]
12 December 2018
06 February 2019
13 March 2019
Further dates to be defined with the students

SEMINARS BY EXTERNAL EXPERTS YES □ NO x

FURTHER INFORMATION

[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.