Università degli Studi della Basilicata

DIPARTIMENTO DI MATEMATICA, INFORMATICA ED ECONOMIA

COURSE: Methods for the Earth Observation	
ACADEMIC YEAR: 2018/19	
TYPE OF EDUCATIONAL ACTIVITY: Affine	
TEACHER: Guido Masiello (3 CFU) Carmine Serio (3 CFU)	
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Language: Italian and English	

ECTS: 6 (6 lessons)	n. of hours: (48 lessons)	Campus: Potenza DIMIE Program: Laurea Magistrale in Ingegneria Informatica e delle Tecnologie dell'Informazione	Semester: I

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This course examines the basic of the interaction between radiation and matter in the Earth atmosphere. The main objective of the course is to provide theoretical fundamentals for face problems of Remote Sensing

The main knowledges provided are

- Basic of Thermodynamics
- Basic of Optics
- Basics of Atmospheric Physics
- Fundamentals of Radiative Transfer.

The main skills obtained will be:

- To Identify Atmospheric Phenomena
- To Estimate geophysical parameters from remote measurements
- To analyse and to deal with Satellite data
- To use advanced tools for Scientific Calculus.

PRE-REQUIREMENTS

The course pre-requirements are:

- Knowledge of Mechanics fundamentals Conoscenza dei concetti fondamentali di meccanica
- Knowledge of Electromagnetism fundamentals;
- Knowledge of Differential and Integral calculus fundamentals
- Knowledge of numerical analysis basics

SYLLABUS

1. Temperature fundamentals: Temperature and heat. Kinetic theory of gases, Ideal gas law, Thermodynamic process, First law of thermodynamics, Second law of thermodynamics

2. Review of Electromagnetism: Maxwell Equations and Electromagnetic waves . Wave propagation.

Optics fundamentals: Reflection, Refraction and Dispersion of the light. Interference and Diffraction. Michelson Interferometer.

4. Fundamentals of Radiation: Planck law for the black body. Wien low. Stefan–Boltzmann law. Absorption, Emission and Scattering. Kirkhhoff low. The Sun. Solar radiation. Solar structure. Solar constant. Solar spectrum.

5. Basics of Atmospheric Physics: Thermal and Chemical Structure of the Atmosphere. Water vapour. Adiabatic lapse rate. Cloud formation. The carbon cycle.

6. Fundamentals of Radiative transfer in gray atmosphere. Schwartzchild Equation for radiative transfer. Radiative Equilibrium. Greenhouse Effect.

7. Fundamentals of Line by Line Radiative transfer: Atomic absorption spectrum. Molecular absorption spectrum. Line shape. Absorption coefficient and transmittance. Scattering. Line-by-line radiative transfer models. Radiative transfer in presence of clouds.

8. Inverse problems: Retrieval of geophysical parameters. EOF (Empirical Orthogonal Function) Methodology.

TEACHING METHODS

The Course is organized as follows:

- Theoretical lessons (48 hh)

EVALUATION METHODS

Oral examination.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Lessons Transparencies available at http://www2.unibas.it/gmasiello/home.html#Did.
- Textbooks:
  - D. Halliday, R., Resnick, J. Walker. Fondamenti di Fisica, Casa Editrice Ambrosiana, 2015 (Chapters. 14, 18, 19, 32, 33, 34, 35 and 36)
  - K. N. Liou, "An Introduction to Atmospheric Radiation", Academic Pres. (Chapters 1, 2, 3, 4, 5 and 6)
  - J. Houghton. "The Physics of Atmosphere", Cambridge University Press. (Chapters 1 and 2)
  - W. P. Menzel., "Remote Sensing Applications with Meteorological Satellites". WMO Technical Document (Chapter 3)
  - C. Serio et al. in PAUL N. FINDLEY. Environmental Modelling: New Research. p. 51-88, Nova Science Publishers.

INTERACTION WITH STUDENTS

Students are welcome during the professor's office hours (Thursdays from 16:30 to 18:00). Moreover the professor will be always available for the students after contact by e-mail.

EXAMINATION SESSIONS (FORECAST)[1]

06/02/2019, 27/02/2018, 22/05/2019, 03/07/2019, 24/07/2019, 11/09/2019, 25/09/2019, 11/12/2019

SEMINARS BY EXTERNAL EXPERTS YES X NO □

FURTHER INFORMATION

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