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**COURSE: REMOTE SENSING for the ENVIRONMENT**

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**ACADEMIC YEAR: 2019-2020**

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**TYPE OF EDUCATIONAL ACTIVITY: Free choice**

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**TEACHER: Nicola Pergola**

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Language: English

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ECTS: 6 (lessons 4;  
tutorials e practice 2)n. of hours: 56 (lessons 32,  
tutorials e practice 24)**Campus: Potenza**  
**Dept./School: Dipartimento di**  
**Scienze**  
**Program: Geosciences and**  
**Georesources (LM74)****Semester: second**  
**From 02.03.2020 to**  
**31 May 20 - June**  
**2020**

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**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

The course is the first in Remote Sensing of the Environment. It is devoted to teach the main elements and physical principles behind the Earth Observation from space. It will also address the main technologies and methodologies today used, focusing on the passive optical systems. The main objective of the course is to make students able to acquire knowledge about satellite remote sensing methods, principles and technologies and to make them capable to perform basic satellite data analyses for environmental applications.

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**PRE-REQUIREMENTS**

- Basics of Mathematics and Geometry concepts
  - Basics of Classic Physics and electromagnetism
  - Knowledge of Office programs Excel and Powerpoint
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**SYLLABUS****Module 1. Introduction to Remote Sensing (4 hours)**

Introduction to Remote Sensing. Natural sources and signals. Earth Observation from space: spectral, spatial, temporal and intensity signatures.

**Module 2. Physics Laws and Fundamentals (6 hours)**

Fundamental physics laws: Planck's law, Wien's law, Stefan-Boltzmann's law, Rayleigh-Jeans and Wien approximations. Brightness temperature definition. Radiation-matter interactions.

**Module 3. Basics of multi-spectral observation. (6 hours of lessons + 6 hours of practice)**

Basic principle of the multi-spectral observation. Spectral signatures. Basics of spectroscopy. Rutherford-Bohr theory. Atomic spectra.

Practice: computing Planck's function; Rayleigh-Jeans approximation verification. Spectral signatures measure and data processing, analysis and interpretation.

**Module 4. Remote Sensing technologies (8 hours lessons + 4 hours practice)**

Main characteristics of satellite sensors. Scanning and non-scanning radiometers. Satellite platforms: near-polar and geostationary orbiting. Constraints on passive sensor resolutions. Overview of the main past and present satellite Earth observation systems and missions. Technical visit to a EO satellite receiving system.

**Module 5. Remotely sensed Image processing (6 hours of lessons + 8 hours of practice)**

Digital image definition and pre-processing. Calibration, navigation and correction of satellite imagery. Enhancement and filtering techniques. Classification methods. Practice: supervised and unsupervised image classification.

**Module 6. Satellite Remote Sensing application for the Environment (2 hours lessons + 6 hours practice)**

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Examples of satellite remote sensing applications for the environment (e.g. vegetation, temperature)

Practice: Processing and interpretation of multi-spectral satellite images.

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**TEACHING METHODS**

Theoretical lessons, Laboratory tutorials, Technical visits

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**EVALUATION METHODS**

Oral examination.

The exam will be devoted not only at verifying the level of knowledge achieved by the students regarding the topics treated during the course but also to evaluate their ability to link and compare different aspects and contents.

The exam is intended passed if a minimum vote of 18/30 is obtained.

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**TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL**

R. P. Gupta Remote Sensing Geology, Springer & Verlag, (1991).

W.G. Rees, Physical Principles of Remote Sensing, Cambridge University Press (1990)

Slides presented during the theoretical lessons

Other possible books:

P.J. Curran, Principle of Remote Sensing, Longmann (1985).

J.B. Campbell Introduction to Remote Sensing, Taylor & Francis (1996)

N. M. Short The Remote Sensing Tutorial Edited by Jon Robinson: disponibile in biblioteca come iper-testo su CD-ROM e consultabile sul sito internet della NASA: <http://code935.gsfc.nasa.gov/Tutorial/TofC/Coverpage.html>

P. M. Mather, Computer Processing of remotely-sensed images, J. Wiley & sons (2006).

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**INTERACTION WITH STUDENTS**

During the course, the professor will make all the material (i.e. slides) available for the students, periodically updating it.

Receiving timetable: Wednesday and Friday, 10:00 to 12:00 at CNR-IMAA, C.da S. Loja, Zona Industriale di Tito Scalo.

In addition, the professor is available by e-mail.

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**EXAMINATION SESSIONS (FORECAST)<sup>1</sup>**

07/07/2020, 31/07/2020, 31/08/2020, 29/09/2020, 27/10/2019, 18/12/2020

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SEMINARS BY EXTERNAL EXPERTS    YES     NO

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**FURTHER INFORMATION**

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<sup>1</sup>Subject to possible changes: check the web site of the Teacher or the Department/School for updates.