UNIVERSITÀ DI PAVIA

Anno Accademico 2015/2016

RADAR REMOTE SENSING

Enrollment year	2015/2016
Academic year	2015/2016
Regulations	DM270
Academic discipline	ING-INF/02 (ELECTROMAGNETIC FIELDS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRONIC ENGINEERING
Curriculum	SPACE COMMUNICATION AND SENSING
Year of study	1°
Period	2nd semester (29/02/2016 - 10/06/2016)
ECTS	6
Lesson hours	45 lesson hours
Language	ENGLISH
Activity type	WRITTEN AND ORAL TEST
Teacher	DELL'ACQUA FABIO (titolare) - 6 ECTS
Prerequisites	Basic knowledge from undergraduate courses in general information engineering. Having attended the "Introduzione al telerilevamento/Introduction to remote sensing" course is an asset.
Learning outcomes	Basic knowledge of data produced by remote sensing and information that can be extracted from them. Capability to evaluate the usefulness of different types of data to solve a given problem of detection, tracking, classification or even more complex ones. Basic skills in processing remotely sensed images through dedicated - and also general - software. Radar remote sensing is emphasized, although not treated exclusively, and industry-related applications are stressed thank to the tight connection with the Lombardy Aerospace Industry Cluster.
Course contents	This course is intended to provide a basic grasp on remote sensing to electronics engineering students. Remote Sensing, especially where

Earth Observation is concerned, is increasingly used in various application fields and it is a booming employment market hooked to the general space industry growth. The course will set students to a good start in this field by providing both a theoretical background and practical examples including experiments with real-world Earth Observation data, far beyond the sheer Google Earth collage of images. The connection with the Lombardy Aerospace Industry Cluster drives the tuning of the course syllabus towards the hottest topics on the marketplace.

Basic concepts

• what is remote sensing
• physical principles: EM waves interactions with matter
• sensors and platforms, ground-based, air-borne, space-borne

Sensors

What is remote sensing and what comes out of it.

• bands of the electromagnetic spectrum
• different types of sensors, their classification and characteristics
• optical sensors: multi- and hyper-spectral
• (synthetic aperture) radar
• examples of real-world sensors
• the Italian satellite constellation, COSMO/SkyMed

Data processing

How to process remotely sensed data

• remotely sensed data: characteristics and organization
• radiometric correction
• geometric correction
• enhancement techniques

Information extraction

Once the data has been prepared, how to extract the relevant information from them.

• revision on signal theory and stocastic variables
• classification and reference data
• supervised and unsupervised classification
• contextual and object-based classification
• accuracy estimation

Radar detection and surveillance

Theory and practice of radar surveillance.

• decision and detection theory
• error probability
• mono- and multi-pulse detection
• moving object identification
• tracking and classification of backscattering objects

Radar Interferometry

Exploiting phase information.

• synthetic aperture radar
• interferometry and interferometric processing
• disturbance factors
• differential interferometry
• interferometric coherence
• risk-related applications

Hands-on exercises

Exercises in processing real-world data using dedicated and general software.

Teaching methods	Lezioni (ore/anno in aula): 45 Esercitazioni (ore/anno in aula): 0 Attività pratiche (ore/anno in aula): 0
Reccomended or required readings	Mark A. Richards (Editor), James A. Scheer (Editor), William A. Holm (Editor) . Principles of Modern Radar: Basic Principles. Scitech Publishing - Raleigh, NC.
Assessment methods	Oral examination.
Further information	Oral examination.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile