



Laurea Magistrale Atmospheric Science and Technology (LMAST)



SUBJECT TITLE	Satellite geodesy and geomatics
TEACHER NAME(S)	Maria A. Marsella (6 CFU)
<i>Teacher e-mail (s)</i>	Maria.marsella@uniroma1.it
<i>Teacher phone</i>	+39 06 44585098
<i>Teacher meeting</i>	Wednesday h10-11
<i>Teacher office address</i>	Via Eudossiana 18, 00184, Roma – D-Building
DISCIPLINE (SSD)	ICAR-06 - Geomatics
<i>Semester (1-4)</i>	2 - Rome
<i>Credits (CFU/ECTS)</i>	60
<i>Lecture hours (h)</i>	60 (45 lectures + 15 exercise/laboratory)
<i>Prerequisite and learning activity</i>	Physics, algebra, statistics
<i>Teaching language and method</i>	English – Lectures, exercises and lab works
<i>Assessment method</i>	Discussion on a project work
SUBJECT WEBSITE	https://corsidilaurea.uniroma1.it/it/node/2195940

OBJECTIVES <ul style="list-style-type: none">▪ provide a general background on satellite missions for measuring and mapping environmental and land parameters▪ understand the main aspects for extracting georeferenced data and evaluating their spatial accuracy▪ examine different EO data useful for positioning and mapping atmospheric and geophysical parameters▪ experiment data processing techniques using tutorial datasets
OUTCOMES (Dublin descriptors: knowledge, understanding, explain, skill, ability) <ul style="list-style-type: none">▪ know the methods for georeferencing and mapping earth parameters derived from satellite observation▪ address the main applications of remote sensing in geomatics, civil and environmental engineering▪ understand the user requirements for monitoring services based on Earth observation data▪ deal with multi-source geospatial data integration to implement GIS tools▪ exploit remote sensing products and the processing chains for extracting maps and georeferenced parameters▪ experiment data processing techniques to perform image georeferencing and extract geo-databases
PROGRAM CONTENT <p>REFERENCE COORDINATE AND TIME SYSTEMS - Cartesian Coordinate Systems and Coordinate Transformations - Reference Frames - Conventional Inertial Systems - Reference Systems in the Gravity Field of Earth - Ellipsoidal Reference Coordinate Systems - Ellipsoid, Geoid and Geodetic Datum - World Geodetic System (WGS84) - Sidereal Time and Universal Time - Atomic Time - Ephemeris, Dynamical and Terrestrial Time - Clocks and Frequency Standards</p> <p>OBSERVATIONS - Observables and Basic Concepts - Fundamentals of Wave Propagation - Determination of Directions, Ranges, Range Differences (Doppler method) - Interferometric Measurements - Optical Observations and Spatial Triangulation - CCD Observations - Weather satellite instruments - Multi-spectral imagers - UV and X-ray irradiance sensors - magnetometers - In-situ validation - Error Budget and Corrections -</p> <p>ATMOSPHERIC MODELLING - Structure of the Atmosphere - Signal Propagation through the Ionosphere and the Troposphere - Ionospheric Refraction - Tropospheric Refraction - Earth Rotation and Relativistic Effects</p> <p>GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) - Signal structure - Observables and Data Processing - Parameter Estimation - Ambiguities and Cycle Slips - Error Budget and Corrections - Ionospheric Effects - Tropospheric Propagation - Differential GPS and Permanent Reference Networks - Real Time Kinematic GPS - Multiple Reference Stations - Wide Area Differential GPS - Network Design</p> <p>LASER RANGING - Systems and Components - Corrections, Data Processing and Accuracy - Parameter Estimation - Earth Gravity Field, Precise Orbit Determination (POD) - Positions and Position Change, Earth Rotation, Polar Motion</p> <p>SATELLITE ALTIMETRY Measurements, Corrections, Accuracy - Geometry of Altimeter Observations - Data Generation - Corrections and Error Budget - Determination of the Mean Sea Surface - Applications of Satellite Altimetry - Geoid and Gravity Field Determination - Geophysical Interpretation - Oceanography and Glaciology</p> <p>VERY LONG BASELINE INTERFEROMETRY - Basic Concept, Observation Equations, and Error Budget - Applications - International Cooperation, International VLBI Service (IVS)</p> <p>INTERFEROMETRIC SYNTHETIC APERTURE RADAR (INSAR) Basic Concepts, Synthetic Aperture Radar (SAR) - atmospheric effects on signal propagation - Amplitudes and Coherence maps and Differential Radar Interferometry</p>
REFERENCES AND MATERIAL <ul style="list-style-type: none">- Texts and slides provided by the teachers and available on the course web site.- Wolfgang Torge - Geodesy - Walter de Gruyter (ISBN13: 9783110124088)



**Laurea Magistrale
Atmospheric Science and Technology (LMAST)**

