UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2023/2024		
BACHELOR'S DEGREE (BSC)	ENVIRONMENTAL ENGINEERING FOR SUSTAINABLE DEVELOPMENT		
INTEGRATED COURSE	CARTOGRAPHY AND REMOTE SENSING - INTEGRATED COURSE		
CODE	21117		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	ICAR/06, ICAR/02		
HEAD PROFESSOR(S)	CIRAOLO GIUSEPPE	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	CIRAOLO GIUSEPPE MALTESE ANTONINO	Professore Ordinario Ricercatore a tempo determinato	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		

TEACHER OFFICE HOURS

CIRAOLO GIUSEPPE

Tuesday	11:00	13:00	Ufficio del Professore (II piano Ed. 8 - blocco "Idraulica")
Thursday	11:00	13:00	Ufficio del Professore (II piano Ed. 8 - blocco "Idraulica")
Friday	9:00	14:00	Per gli studenti del CdS in Biotecnologie e Innovazione Tecnologica, presso le strutture del polo didattico di Trapani. I ricevimenti, su richiesta, possono essere svolti anche su piattaforma teams. Ulteriori o differenti incontri possono essere concordati con il docente

MALTESE ANTONINO

Monday	15:00	16:00	Viale delle Scienze, Dipartimento di Ingegneria, Ed. 8, II piano, Area Trasporti e Geomatica, Stanza 2051
Tuesday	15:00	16:00	Viale delle Scienze, Dipartimento di Ingegneria, Ed. 8, II piano, Area Trasporti e Geomatica, Stanza 2051
Wednesday	15:00	16:00	Viale delle Scienze, Dipartimento di Ingegneria, Ed. 8, II piano, Area Trasporti e Geomatica, Stanza 2051
Thursday	15:00	16:00	Viale delle Scienze, Dipartimento di Ingegneria, Ed. 8, II piano, Area Trasporti e Geomatica, Stanza 2051

DOCENTE: Prof. GIUSEPPE CIRAOLO

PREREQUISITES	Informatics basics
LEARNING OUTCOMES	Knowledge and understanding At the end of the course, the student will have knowledge of the problems inherent in digital mapping of GIS and environmental monitoring using remote sensing techniques. In particular, the student will be able to understand and use all the basic techniques for the construction of a geographic information system and for the treatment of multispectral images acquired from aircraft and satellites. Particular attention will be paid to digital cartography, the various data sources, the electromagnetic energy-object interaction, the spectral response of objects and the techniques for deriving bio-physical variables from radiometric data. Ability to apply knowledge and understanding The student will be able to use advanced tools for the implementation of a GIS, for the analysis of digital images, remote sensing and image processing software to address problems related to the monitoring of environmental variables; The student will be able to use remote sensing techniques and methodologies to evaluate the state of pollution of water bodies and to set up decision support systems in the field of water resource management in agriculture. Furthermore, the student will be able to develop territorial information systems using the most common GIS software. Judgments ability The student will be able to analyze and explore spatially distributed data and data acquired from remote sensors; will be able to collect and organize a sampling of environmental data in the GIS, to integrate these data with spatially distributed information acquired from a remote platform and to formalize judgments about the possible presence of environmental emergencies. Communication skills The student will acquire the ability to communicate and express problems related to the object of the course. He/she will be able to hold conversations on GIS implementation, cartography, data acquired from remote and in situ platforms, and highlight issues related to integrating such data into modeling and offer different solutions. Learning skills The student will have learned the importance of digital image processing software and earth observation methods in the field of environmental and territorial monitoring and in the resolution of environmental problems (both terrestrial and marine) and this will allow him to continue his engineering studies with greater autonomy and discernment.
ASSESSMENT METHODS	The exam will be oral with single test, even for students not attending the lectures. The candidate has to answer at least three questions posed orally, on the elaborate developed during practical classes and on all topics included in the program and during the course. Final assessment aims to evaluate whether the student has knowledge and understanding of the topics, has acquired jurisdiction to interpret and independent judgment of concrete cases. The pass mark will be reached when the student shows knowledge and understanding of the subjects at least in general terms, and has domain expertise in order to solve concrete cases; It will also have presentation skills and argumentative as to allow the transmission of his knowledge to the examiner. Below this threshold, the examination will be insufficient. The more, however, the examinee with its argumentative and presentation skills can interact with the examiner, and the more his knowledge and application capabilities go into detail on the subject of discipline occurs, the more the assessment is positive. The assessment is carried out of thirty. Details of the valuation methods: Excellent: 30 - 30 cum laude Outcome: excellent knowledge of the topics, excellent properties of language, good analytical ability, the student is able to apply knowledge to solve problems proposed. Very good: 26 - 29 Outcome: good control of the subjects, full ownership of the language, the student is able to apply knowledge to solve problems proposed. Good: 24 - 25 Outcome: basic knowledge of the main topics, discrete properties of language, with limited ability to independently apply the knowledge to the solution of the proposed problems. Satisfactory: 21 - 23

	Outcome: the candidate does not have full command of the main teaching subjects but it has the knowledge, satisfactory property language, poor ability to independently apply the knowledge acquired. Sufficient: 18 - 20 Outcome: minimum basic understanding of the main teaching and technical language issues, very little or no ability to independently apply the knowledge acquired. Insufficient Outcome: the candidate does not have an acceptable knowledge of the contents of the topics covered in the teaching.
TEACHING METHODS	Frontal lecturing, practical, field visits

MODULE
CARTOGRAPHY AND TIS

Prof. ANTONINO MALTESE

SUGGESTED BIBLIOGRAPHY

In Italiano

R. Cannarozzo, L. Cucchiarini, W. Meschieri, Zanichelli, Bologna, Edizione 2017. Misure, rilievo, progetto. Per costruzioni, ambiente e territorio., ISBN-10 8808520900
F. Migliaccio, D. Carrion, Sistemi informativi territoriali. Principi e applicazioni. Ed. UTET Università, 2019, ISBN: 8860086078, 9788860086075

In English
Engineering Surveying Manual, American Society of Civil Engineers, 1985. 978-0-87262-460-3 (ISBN-13) | 0-87262-460-9 (ISBN-10),
Hoffmann-Wellenhof B., Lichtenegger H., Collins J.Global Positioning System, Springer Verlag Wien New York. ISBN 978-3-7091-6199-9
P. A. Longley, D. J. Maguire, M. F. Goodchild, D. W. Rhind. Geographic Information Systems and Science (Vol. 1), Wiley, John & Sons. ISBN: 0471–33132–5 (Volume 1)

AMBIT	50282-Ingegneria della sicurezza e protezione civile, ambientale e del territorio
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

Acquisition of theoretical knowledge and the methodologies for the acquisition and processing of data and to carry out critical evaluations of the results. Create cartographic representations of the territory through GIS techniques.

SYLLABUS

Hrs	Frontal teaching
3	Geodesy principles and reference systems
4	Cartography principles and digital maps georeferencing
3	Principi di tecniche di rilievo geodetico tramite sistemi di posizionamento globale (GPS, GLONASS)
2	Aerial photogrammetry principles
1	Introduction to Geographic Information Systems
3	Vector model
3	Raster model
3	Alphanumeric attributes and queries
6	Processing: Buffering, Overlay, Classification.
4	Basic operations on vector and raster data

Hrs	Practice
3	Cartography
2	GPS survey
2	UAV flight plan
3	Introduction to an open source GIS platform
14	GIS Project work

MODULE
ENVIRONMENTAL REMOTE SENSING

Prof. GIUSEPPE CIRAOLO

SUGGESTED BIBLIOGRAPHY

Giuseppe Ciraolo. – Dispense e slides del corso di Telerilevamento Ambientale.
Shunlin Liang. Quantitative Remote Sensing of Land Surfaces. WILEY ISBN: 978-0-471-28166-5

AMBIT	50278-Ingegneria ambientale e del territorio
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

The general aim of the course is to provide to the students the theoretical knowledges and the operational methodologies of digital image processing of multispectral ad hyoerspectral remote sensing images and to apply the most appropriate environment monitoring technologies. The integration and the synergy of remotely sensed data and in situ data is also an important objective of the course.

SYLLABUS

Hrs	Frontal teaching
1	Remote Sensing - Introduction
3	Physics of Radiation – Fundamental Laws
3	Electromagnetic Energy-matter interactions
2	Remote sensing Platforms and sensors
2	The 4 resolutions in remote sensing
2	Radiometry and colorimetry
2	Radiometry and colorimetry
2	in radiance and in reflectance calibration
2	Interaction with the atmosphere and correction of its effects
2	Techniques of image enhancement
3	Geometric corrections and Georeferencing methods
4	Classification of multispectral and hyper-spectral images
2	Vegetation Indices for agricultural and forestry applications
3	water quality monitoring techniques by means of emote sensing
3	RADAR systems: basic elements and characteristics

Hrs	Practice
3	Spectral signatures acquisitions and elaborations
2	Filtering, histogram manipulation, false colour compositions
4	Calibration and correction of a remote sensing image
3	Georeferencing of a remotely sensed image
3	Albedo, land surface temperature (LST), vegetation indices calculations
3	Classification of a multispectral image