COURSE DATA

DATA SUBJECT

Code: 43542
Name: Applications of remote sensing
Cycle: Master's Degree
ECTS Credits: 10
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2162 - Master's degree in Remote Sensing	Facultat de Física	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2162 - Master's degree in Remote Sensing	Applications	COMPULSORY

COORDINATION

FRANCH GRAS BELEN

SUMMARY

The course Applications of Remote Sensing offers a broad, integrated, and applied overview of the possibilities of remote sensing in various scientific, technical, and professional fields. Its objective is to connect the knowledge acquired by the students during the master's program with real-world Earth observation problems and current lines of research and knowledge transfer.

The course is organized into two phases. The first phase, at the beginning of the course, consists of brief presentations by the research groups involved in teaching the master's program. These sessions are introductory and motivating they allow students to learn about the faculty's research activities, the types of problems that remote sensing addresses, and examples of high-impact research, without requiring advanced technical expertise.

The second phase is conducted through applied seminars. Each seminar combines a theoretical introduction with guided practice in a computer lab or laboratory, focusing on a specific application of remote sensing. Students must attend and participate in at least 10 of the offered seminars. At the end of the course, each student will give a short oral presentation on a remote sensing application related to the seminars attended.

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PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

It is recommended to have completed the subjects Fundamentals of Remote Sensing and Image Processing, and to be currently enrolled in Analysis and Information Extraction, as the applied seminars require an understanding of the physical fundamentals of remote sensing, image access and preprocessing, and basic information extraction techniques.

COMPETENCES / LEARNING OUTCOMES

2162 - Master's degree in Remote Sensing

Aplicar los conocimientos adquiridos con criterios de sostenibilidad de nuestro entorno.

Aplicar técnicas de clasificación supervisada y no supervisada y saber establecer los criterios e idoneidad de cada técnica sobre distintas resoluciones espaciales y espectrales de las imágenes.

Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.

Be able to access to information tools in other areas of knowledge and use them properly.

Conocer las características básicas de los formatos de almacenamiento de las imágenes de teledetección y ser capaz de acceder a ellas y aplicarles todas las correcciones que necesitan según los distintos intervalos espectrales y las técnicas de validación para los distintos tratamientos que requieran.

Conocer y utilizar las fuentes de información bibliográfica y las bases de datos de imágenes de satélite para extraer información, sintetizarla, desarrollarla y aplicarla en aspectos concretos de la teledetección aplicando la metodología de la investigación científica.

Entender, asimilar y saber utilizar los sistemas de información geográfica.

Entender y saber utilizar técnicas avanzadas de tratamiento de imágenes para extraer y analizar la información de interés contenida en las imágenes.

Exponer y defender públicamente el desarrollo, resultados y conclusiones de su trabajo de una manera clara y concisa.

Leer, visualizar y extraer parámetros físicos de los datos que proporcionan las imágenes de satélite en distintos intervalos espectrales y saber aplicar las técnicas de tratamiento de imágenes más generalizadas.

Saber escoger las imágenes idóneas para cada tipo de aplicación a desarrollar de teledetección, realizando las correcciones que requieran y utilizando las técnicas de tratamiento de imágenes más adecuadas al objetivo buscado.

Saber utilizar los programas comerciales de tratamiento digital de imágenes y programar a nivel de usuario de estos.

Ser capaces de realizar una toma rápida y eficaz de decisiones.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

Students should possess and understand foundational knowledge that enables original thinking and research in the field.

Trabajar en equipo con eficiencia.

DESCRIPTION OF CONTENTS

1. Current Research and Applications of Remote Sensing

Introductory sessions led by research groups affiliated with the master's program. Research areas, application examples, and use cases in remote sensing will be presented to contextualize the master's program content and demonstrate its scientific and professional implications.

2. Applications in Agriculture

Evapotranspiration in agriculture. Production forecasting: crop type mapping, area estimation, and yield prediction. Soil moisture measurement using passive microwaves.

3. Applications in Natural Disasters and Climate Change

Radar in geological hazards, including subsidence, landslides, and infrastructure monitoring. Forest fires. Analysis of land-use changes and assessment of agricultural intensification near protected forest areas.

4. Applications in Inland Waters

Water quality assessment using remote sensing techniques.

5. Applications in Atmosphere and Meteorology

Atmospheric remote sensing from the surface. AERONET network and aerosol measurement. Atmospheric pollutants using Sentinel-5. Meteorological applications.

6. Applications in vegetation, forest ecosystems, and 3D structure

Early detection of vegetation stress using biophysical parameters of photosynthesis, such as SIF and PRI. Radiative transfer models in vegetation using ARTMO. Introduction to LiDAR technology and its application in forest inventory.

7. Urban applications

Urban heat island and analysis of urban environments using remote sensing.

8. Final presentation of applications

Preparation and oral defense of a short presentation on a remote sensing application selected by the students or assigned by the coordinator to ensure thematic diversity.

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WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	20,00
Theory	35,00
Computer classroom practice	45,00
Total hours	**100,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	100,00
Independent study and work	50,00
Preparation of lessons	0,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**150,00**

TEACHING METHODOLOGY

The course combines introductory sessions, applied seminars, guided practical sessions, and a final oral presentation.

In the first phase, the research groups involved in the master's program will present their main lines of work and examples of remote sensing applications. These sessions will be orienting and motivating, helping students identify connections between the master's courses, current research, and potential areas of specialization.

In the second phase, 15 applied seminars of 4 hours each will be held. Each seminar will generally be structured into an initial part of approximately 1 hour of theoretical introduction and a second part of approximately 3 hours of practical activity. The practical sessions will be conducted in the classroom, under the supervision of the responsible faculty, using data, tools, or methodologies specific to each application.

Students may attend all the seminars offered; however, attendance and evaluable participation in at least 10 seminars is mandatory. The assessment for each seminar will preferably take place during the session itself, through practical exercises, case studies, interpretation of results, participation, or brief deliverables generated in class.

The course will conclude with a 5-minute individual oral presentation on a remote sensing application. Students may choose the topic from among the applications covered in the course or select one assigned by the course coordinator to avoid excessive focus on a single subject.

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EVALUATION

First Examination Period:

- Evaluation of practical activities developed in applied seminars: 70% of the final grade. This grade will be the average of the grades obtained in the seminars attended by each student. To pass this section, attendance and participation in a minimum of 10 seminars is required. Additional seminars may be included in the average according to the criteria established by the course coordinator at the beginning of the course.

- Final Individual Oral Presentation: 30% of the final grade. The clarity of the presentation, understanding of the selected application, ability to synthesize information, connection to the master's program content, and adherence to the allotted time will be evaluated.

The final grade will be the weighted sum of both sections. To pass the course, a final grade of 5 or higher out of 10 is required, along with meeting the minimum attendance and participation requirement of 10 seminars.

Second Examination Period:

The overall weighting of the first examination period will be maintained. Students who have not met the minimum seminar attendance requirement or have not passed the continuous seminar assessment must complete equivalent practical activities established by the course coordinator, related to the applications covered during the course. The final oral presentation can be retaken in the second examination period through an individual presentation on the

scheduled date

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REFERENCES

Basic:
- Teaching materials, practical guides, databases, technical documentation, and scientific articles provided by the instructors responsible for each seminar through the Virtual Classroom.

- Manuals and official documentation for the missions, sensors, and data platforms used in the practical sessions.

Additional:

- Scientific articles, technical reports, doctoral theses, and specific bibliographic resources for each remote sensing application.

- Documentation of remote sensing data analysis software and environments used in the seminars.

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