

Degree	Type	Year
Management of Smart and Sustainable Cities	OP	4

Contact

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Teaching groups languages

You can view this information at the [end](#) of this document.

Prerequisites

Much of the bibliography of the subject is in English, so students should be able to read at least at a basic level in that language.

Techniques from Geographic Information Systems (GIS) are also widely used, so a thorough understanding of the concepts acquired in other subjects covering this area is assumed. It is therefore recommended to review these concepts and their practical applications. To support this, it may be helpful to watch videos such as those available at <https://www.miramón.cat/ENG/Videos.htm>, as well as consult the corresponding topics in the MiraMon help section, which can be found at the bottom of each video.

Objectives and Contextualisation

In recent years, remote sensing has become a basic tool in geographic analysis thanks to the systematic availability of satellite images and, increasingly, aerial images, whether from aircraft or, lately, from UAV devices like drones. The discipline has experienced a spectacular evolution since the first images available for civil use in the early 1970s to the present day. Nowadays there are many orbiting sensors around the earth's surface that allow us to analyze it in a way never seen. In this sense, the subject represents an interesting opportunity to understand the scope of Remote Perception as a discipline.

In the course, it is not intended to train in a specific software. The message is that in the case of a case of use, the student must know (or learn if necessary) the necessary concepts, understand what strategies it is appropriate to apply and know what tools are available. With this in mind, the maturity of the case of use will allow you to find out what features you need in each situation and choose or adapt to the possibilities that you will find at each moment and place of the future development of your activity. This does not mean that the course does not use professional, free and long-established software (see the Programari/Software section).

Among the objectives presented in the course, which are both theoretical and practical, we should highlight:

- Know the main platforms and sensors available in Remote Sensing. This objective will be achieved through theoretical discourse, the study and a search exercise to be carried out by the students.
- Understand the nature of multispectral images and the characteristic response of the main types found in the soil. The theoretical discourse will be dressed with a series of examples from the most conceptual point of view (spectral band, spectral signatures, electromagnetic spectrum), as practical (evaluation and interpretation of spectral signatures of different covers, false color composites, etc). The practical part of the subject, therefore, will begin with the visualization of images, the definition of the legend and

the demonstration of the spectral separability of different land covers and will progress towards other aspects of interest.

- Know how to perform the basic treatment of the images, from their acquisition to their exploitation for quantitative or categorical thematic cartography. This objective will be achieved in several cases applied until the determination of the thematic accuracy of the obtained cartography and through careful editing of the final maps.
- Learn examples applied in urban environments: land use and land cover, heat islands, digital models of buildings via lidar, etc.

Learning Outcomes

1. CM10 (Competence) Develop projects related to the management, equity and sustainability of cities by applying elements of technological innovation, such as information and communication technologies.
2. KM15 (Knowledge) Identify different primary and secondary sources, models and databases of information generated by urban activity, as well as their operating principles, access policies and standards.
3. SM14 (Skill) Apply sensorisation, data acquisition, processing and communication technologies and systems to the modelling of urban systems.

Content

The subject is taught in Catalan.

The various aspects to be developed in the subject are:

1. Overview of Remote Sensing.
2. The electromagnetic spectrum and the spectral signatures.
3. Remote sensing basic concepts: spatial, radiometric, spectral and temporal resolution.
4. Types of platforms and sensors. Main satellites and sensors.
5. Nature of the images. Formats. Elemental notions of geometric and radiometric corrections. Calculation of vegetation indices. Use of digital terrain models.
6. Reading and interpretation of satellite images in digital format.
7. Techniques of digital classification. Verification of results. Final cartographic refinement. Post-classification techniques.
8. Remote sensing applications for urban areas. Land cover, lidar and thermal remote sensing cases.

The application in practical cases will be developed throughout the course, in an integrated way in the various subjects covered in the course.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Approach to the objective and method of solving the practices	15	0.6	CM10, KM15, SM14, CM10
Exposure of basic concepts	35	1.4	CM10, KM15, SM14, CM10
Practices carried out autonomously by the students	40	1.6	CM10, KM15, SM14, CM10

Type: Supervised

Guided resolution of the practices in the computer lab	10	0.4	CM10, KM15, SM14, CM10
Type: Autonomous			
Preparation and presentation of results	15	0.6	CM10, KM15, SM14, CM10
Study of theoretical material	30	1.2	CM10, KM15, SM14, CM10

The contents of the subject will be developed through the following activities:

- Documentation and reading guides presented by the teacher.
- Reading of chapters of books or articles (individual activity of the students complementary to the classroom work).
- Practice development guides provided by the teacher.
- Practices carried out autonomously by the students based on proposals from the teacher.

For the accomplishment of the subject specific software will be used (MiraMon).

The preferred communication channel with students will be by email and scheduled tutorials when necessary. The virtual platform is the moodle site of the subject.

For this subject, the use of Artificial Intelligence (AI) technologies is permitted exclusively in support tasks, such as bibliographic or information searches, text correction or translations. The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. The lack of transparency in the use of AI in this assessable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical exams	30%	3	0.12	CM10, KM15, SM14
Practical exercises	20%	0	0	CM10, KM15, SM14
Theoretical exams	50%	2	0.08	CM10, KM15, SM14

The assessment activities are:

- Exams with theoretical content (the grade in each will represent 25% of the final grade) and practical (15% of the final grade each), carried out throughout the course (one halfway through the course, the other at the end). These exams will be face-to-face, on dates indicated in due course.
- Practical exercises delivered throughout the course (20% of the grade).

The final grade will be obtained by weighted arithmetic average with the percentages indicated above. The pass is obtained with a 5.0. Both the student who has not submitted the requested work and the one who has not presented any of the theoretical-practical tests will be considered "non-evaluable".

Students classified as "Not Pass" due to not achieving the minimum required grade in any assessment activity will receive the grade corresponding to their test score. Similarly, the final grade will reflect the weighted arithmetic average of all assessment activities, as previously indicated.

For the honors registration it is necessary to obtain a minimum of 9.1 and verify the rest of the conditions that depend on the number of students enrolled in the course.

No differentiated treatment is considered for repeating students.

The recovery will be of the entire theoretical and practical syllabus, within the dates stipulated for this purpose by the Faculty. The review of grades for each assessment activity is done by writing an email to the responsible teacher in order to specify the date and time.

Copying or plagiarizing material, both in the case of assignments and in the case of exams, constitutes a crime that will be sanctioned with a zero in the activity. In the event of a repeat offense, the entire subject will be suspended. We remember that "copying" is considered a work that reproduces all or a large part of the work of another classmate. "Plagiarism" is the act of presenting all or part of a text by an author as your own, without citing the sources, whether on paper or in digital format. You can see UAB documentation on "plagiarism" at: http://wuster.uab.es/web_argumenta_obert/unit_20/sot_2_01.html.

If the student commits any irregularity that could lead to a significant variation in the grade of an assessment act, this assessment act will be graded 0, regardless of the disciplinary process that may be instructed. In the event that several irregularities occur in the assessment acts of the same subject, the final grade for this subject will be 0.

In the event that the tests cannot be taken in person, their format will be adapted (maintaining their weighting) to the possibilities offered by the UAB's virtual tools. Homework, activities and participation will be carried out through forums, wikis and/or exercise discussions through Teams, etc. The teacher will ensure that the student can access them or will offer alternative means, within their reach.

No single evaluation is planned.

Bibliography

Manuels i cartografia de referència

- Arbiol, R., O. Viñas, J.M. Camarasa i V. Palà (1986). "Mapa d'usos del sòl de Catalunya a partir de dades del satèl·lit Landsat-2". Institut Cartogràfic de Catalunya. Barcelona. 154 pàgs. + 1 mapa.
- Barret, E. C. i L. F. Curtis (1999). *"Introduction to Environmental Remote Sensing"*. Cheltenham, Stanley Thornes Publishers Ltd.
- Campbell, J. B. i Wynne, R.H., Thomas, V.A (2022). *"Introduction to Remote Sensing"*, New York, The Guilford Press. 634 p. 6^a ed.
- Chuvieco, E. (2010). *"Teledetección Ambiental"*, Barcelona, Ariel. 592 pàgs. 3^a edició.
- Colwell, R.N. (1983). *"Manual of Remote Sensing"*. American Society of Photogrammetry. Falls Church. Virginia. 2 vol.
- Conway, E. D. (1997). *"An introduction to satellite image interpretation"*, Baltimore, John Hopkins University Press.
- Cracknell, A. P. i L. W. B. Hayes (2007). *"Introduction to Remote Sensing"*, London, CRC Press, Boca Ratón. 335 pàgs. 2^a edició (1^a edició de 1991).
- Díaz-Delgado, R., Lucas, R. and Hurford, C. (Eds.) (2017). *"The Roles of Remote Sensing in Nature Conservation. A Practical Guide and Case Studies"*. Springer International Publishing AG2017. Pp. 318. Springer, Cham, Switzerland.

- Emery, W. i A. Camps (2017). "*Introduction to Satellite Remote Sensing. Atmosphere, Ocean, Land and Cryosphere Applications*". Elsevier. 860 pàgs.
- Fra, U. (2011). "*Diccionari terminològic de fotogrametria*". Barcelona: Institut Cartogràfic de Catalunya: Enciclopèdia Catalana. 351 p
- Girard, M.C. i C.M. Girard (1999). "*Traitement des données de télédétection*". Dunod. Paris. 529 pàgs. ISBN 2-10-004185-1.
- Gandía, S. i J. Melià (1991). "*La teledetección en el seguimiento de los fenómenos naturales. Recursos renovables: Agricultura*". Departament de Termodinàmica. Universitat de València.
- Institut Cartogràfic de Catalunya (1992) "*Mapa d'usos del sòl de Catalunya*". Institut Cartogràfic de Catalunya. Barcelona. 118 pàgs. + 20 làmines + 1 mapa.
- Jensen, J.R. (2016). "*Introductory Digital Image Processing. A Remote Sensing Perspective*". Prentice Hall. Englewood Cliffs. 656 pàgs. 4^a edició.
- Lillesand, T.M., R.W. Kiefer i J. Chipman (2015). "*Remote Sensing and Image Interpretation*". John Wiley & Sons. N.Y. 736 pàgs. 7^a edició.
- Mather, P.M. i M. Koch (2010). "*Computer Processing of Remotely-Sensed Images*". J. Wiley & Sons. Chichester. 460 pàgs. 4^a edició.
- Nunes, J. (2012). "*Diccionari terminològic de sistemes d'informació geogràfica*". Enciclopèdia Catalana i Institut Cartogràfic de Catalunya, Barcelona. 551 p.
- Paine, D. i J. Kiser. (2003). "*Aerial Photography and Image Interpretation*". J. Wiley & Sons. Chichester. 648 pàgs. 2^a edició.
- Pinilla, C. (1995). "*Elementos de Teledetección Espacial*". Madrid, RA-MA.
- Pons, X., Arcalís A. (2012). "*Diccionari terminològic de Teledetección*". Enciclopèdia Catalana i Institut Cartogràfic de Catalunya, Barcelona. 597p. Disponible online: http://www.termcat.cat/ca/Diccionaris_En_Linia/197
- Rabella, J.M., Panareda, J.M., Ramazzini, G. (2011). "*Diccionari terminològic de cartografia*". Enciclopèdia Catalana i Institut Cartogràfic de Catalunya, Barcelona. 417 pàgs.
- Rees, W.G. (2012) "Physical principles of remote sensing", Cambridge University Press. Cambridge. 3^a edició. 492 pàgs.
- Richards, J. A. i X. Xia (2005). "*Remote Sensing Digital Image Analysis. An Introduction*". Berlin, Springer-Verlag. 439 pàgs. 4^a edició.
- Schowengerdt, R. A. (2006). "*Remote Sensing. Models and methods for image processing*". San Diego, California, Academic Press. 560 pàgs. 2^a edició.
- Sobrino, J. A. (Ed.) (2000). "*Teledetección*". València, Servei de Publicacions, Universitat de València.
- Ustin, S. (Ed.) (2008). "*Remote Sensing for Natural Resource Management and Environmental Monitoring*". (Manual of Remote Sensing - Third Edition), Wiley and American Soc. of Photogrammetry and Remote Sensing. New York. 768 p.
- Xian, G. (2016). "Remote Sensing Applications for the Urban Environment". Boca Raton: CRC Press
- Yang X. (2011) "Urban Remote Sensing: Monitoring, Synthesis and Modeling in the Urban Environment". Wiley Blackwell Chichester.

Principals revistes científiques

- *Remote Sensing of Environment*. Elsevier Science Publishing Co. Inc.
- *IEEE Transactions on Geoscience and Remote Sensing*. Institute of Electrical and Electronics Engineers. També editen *IEEE Geoscience and Remote Sensing Letters*, amb articles més curts i una més ràpida dinàmica de publicació.
- *Photogrammetric Engineering & Remote Sensing*. American Society for Photogrammetry and Remote Sensing.
- *International Journal of Remote Sensing*. Taylor & Francis Ltd.
- *Canadian Journal of Remote Sensing*. Canadian Aeronautics and Space Institute
- *ISPRS Journal of Photogrammetry and Remote Sensing*. International Society for Photogrammetry and Remote Sensing.
- *International Journal of Applied Earth Observation and Geoinformation*. Elsevier Science Publishing Co. Inc.
- *Remote Sensing*. MDPI
- *Revista de Teledetección*. Asociación Española de Teledetección.
- *GeoFocus*. Asociación Española de Geografía

Software

MiraMon. Geographic Information System and Remote Sensing software. 1994-2025.

The version to be used is the desktop (v. 10) one for Windows (64 and 32 bits), freely downloadable from <https://www.miramon.cat/mus/ENG/index.htm> and also available in the classroom.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.