Universitat Autònoma de Barcelona

2021/2022

Innovation and Smart Cities

Code: 43854
ECTS Credits: 6

Degree	Type	Year	Semester
4315985 Geoinformation	OT	0	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: spanish (spa)

External teachers

Anna Tardà Lleget

Jordi Corbera Simón

Jordi Martín Oriol

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Prerequisites

This course has no specific requirements. Students should only have a basic knowledge of using general software such as Windows, Excel and Word.

Objectives and Contextualisation

The course main goal is to provide a defined context for the development of geoinformation products and services that has a strong innovation character. Therefore the course is focused on the most dynamic sector of geospatial information application, that is the intelligent management of processes in urbann systems known as smart cities and Internet of things. They made possible to link thorugh the net the operation of systems and of everyday objects both in public and private activities, making use of geolocation and geospatial content in order to customize and contextualize the services provided and the behavior of systems.

The course includes a revision of current trends in urban development and management, and also of planning and management policies for urban development and service supply, with particular focus on opportunities for the implementation of smart services. At the same time, the course offers a broad overview of innovation models and strategies, and also of the resources for devising R+D+I projects and for dissemination and achievement of the multiplying effects of innovations.

Competences

- Apply the physical fundamentals of the observation of the Earth to the analysis and treatment of data from remote sensors.
- Continue the learning process, to a large extent autonomously.
- Design and manage geospatial information application products or services.

- Design intelligent applications of geospatial information for managing cities and region (smart cities) and for managing their implementation.
- Develop and apply geospatial and alphanumeric information analysis methodologies to resolve urban or land management problems, generating useful information for the implementation of intelligent processes and for decision making.
- Develop imaginative, creative and innovative ideas in projects for geospatial information systems, services, products or applications.
- Identify and use navigation and positioning systems and techniques precisely and reliably with the various different assumptions of navigation and data collection in the field.
- Integrate geospatial information technologies, services and applications with the aim of providing an optimal solution to each application case.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use knowledge critically and understand and take on board the ethical responsibility, legislation and social implications of the use and diffusion of geospatial information and its derived products.

Learning Outcomes

1. Analyse the financial, social and environmental sustainability of smart city-management and land-use projects.
2. Apply acquired knowledge and skills to real problem-solving in urban environments.
3. Apply sensor-acquired data to the management of urban services.
4. Assess the social implications of using spatial analysis tools in environmental and land-use decision-making.
5. Continue the learning process, to a large extent autonomously.
6. Design and implement methodologies for analysing sensor-acquired data in order to improve the efficiency of urban systems.
7. Design localisation-based services for the smart management of urban services.
8. Determine the state of the art of the different technologies related to geoinformation and R+D lines in the sector, together with that of information and data management policies at national, European and global levels.
9. Develop imaginative, creative and innovative ideas in projects for geospatial information systems, services, products or applications.
10. Integrate geospatial information technologies, services and applications with the aim of providing an optimal solution to each application case.
11. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
12. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
13. Use knowledge critically and understand and take on board the ethical responsibility, legislation and social implications of the use and diffusion of geospatial information and its derived products.
14. Work in multidisciplinary teams to generate sustainable solutions for cities.
15. Write and manage R&D projects in the field of smart city management.

Content

Urban dynamics and planning and management policies

1. Contemporary urbanization process: urban fabric transformation and delimitation.

    Urbanization concept and contemporary urbanization process background.

    Major trends in the urbanization process and its implications in the urban fabric: expansion, integration and dispersion.

Urban areas delimitation conflicts: legal status, urban morphology, functional relationships, economic structure, services hierarchy.

2. Territorial elements in the city definition: urban form.

   Identification and delimitation of urban areas based on urban form.

   Tools to analyze urban form: Urban Atlas, SIOSE, MCS-CREAF, CartoCiudad, Land Registry.

   Tools to analyze land uses according to legal status: Master Plans and the Catalan Urban Map.

3. Opportunities and challenges of urbanization and its impact on urban networks.

   Environmental challenges: resources and energy.

   Functional challenges: urban mobility.

   Social challenges: the demand of services.

4. City definition through infrastructure and services networks: network density and equipment.

   Water cycle, energy and telecommunications.

   Network transport: people and goods.

   Urban supply values: public amenities.

5. Social agents and urban uses.

   Urban uses according incomes.

   Measuring the urban segregation.

   Urban location and specialization urban fabric.

6. City definition according volume, density and activity.

   People and housing.

   Homes and buildings.

   Activity and working places.

7. City definition according mobility urban flows.

   Motivation.

   Mode.

   Direction.

   Recurrence.

8. City definition according accessibility and mobility.

   Mobility paradoxes.

   Residential mobility.

   Activity mobility.

   Frequent mobility.

9. City definition according transport models.

The role of Metropolitan Transport Authorities.

Mobility planification: transport accessibility as an universal right.

10. Potentialities, legal limitations, political limitations and ethical limitations in the GIS uses.

Governance of urban processes.

Administrative structures and GIS competences.

The GIS European, Spanish and Catalan institutional architecture in terms of Geographic Information.

R+D+I for smart cities

1. Introduction to smart cities.

Background.

Future challenges.

2. Earth Observation from sensors.

Sensors and urban scales.

Airborne sensors for smart cities.

Examples of smart cities and sustainable cities.

3. Geoinformation and smart cities.

Urban land covers and Local Climate Zones.

Justice Maps concept.

Green and blue cities concept.

4. Climate and smart cities.

Urban Heat Island and heat wave.

Health and life quality.

Transport and mobility.

5. Smart cities and international study cases.

Barcelona as smart city.

Other smart cities.

Cities strategies with COVID-19

Methodology

Learning is achieved by means of three types of activities:

Directed activities: Directed activities are theoretical and practical lectures in a computer lab. They include solving case studies and practical exercises, using as the main method a problem based learning approach. Lectures serve to systematize all the content, to present the state of the art of the different subjects, to provide

methods and techniques for specific tasks, and to sum up the knowledge to learn. Lectures organize also the autonomous and complementary work done by the students.

Supervised activities: Supervised activities are focused on the execution of a semester project, consisting of a real case study, carried out through workshop hours, autonomous work and tutorials. This semester project allows to apply together all the knowledge and technical skills learnt in all the courses of the semester. The semester project is a milestone for the students and the actual demonstration that they had achieved the learning goals of all the courses of the semester. It is also the main evidence for evaluation as students should have to submit at the end of the semester a report that summarizes the whole project and do an oral presentation.

Autonomous activities: Autonomous work of the students includes personal readings (papers, manuals, relevant reports, etc.), data and documentation search, complementary exercises and the personal development of the semester project.

The activities that could not be done onsite will be adapted to an online format made available through the UAB's virtual tools. Exercises, projects and lectures will be carried out using virtual tools such as tutorials, videos, Teams sessions, etc. Lecturers will ensure that students are able to access these virtual tools, or will offer them feasible alternatives.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures on basic concepts	36	1.44	1, 8, 6, 10, 11, 4
Type: Supervised			
Semester project, exercises and oral presentations	15	0.6	1, 3, 9, 7, 11, 12, 5, 14
Type: Autonomous			
Practical exercises	69	2.76	9, 6, 7, 12, 5, 13, 4

Assessment

In the event that assessment activities cannot be taken onsite, they will be adapted to an online format made available through the UAB's virtual tools (original weighting will be maintained). Homework, activities and class participation will be carried out through forums, wikis and/or discussion on Teams, etc. Lecturers will ensure that students are able to access these virtual tools, or will offer them feasible alternatives.

CONTINUOUS EVALUATION

a) Evaluation procedure and activities:

Evaluation of the course is based mostly on the semester project, that comprises two evaluation activities. The elaboration and submission of a synthesis report and the oral presentation of the project done. Given the technical content of the course, the weight assigned to the project report is 45% of the total course grading, assuming that it is the most appropriate means to explain all the technical details of the project, and a weight of 25% at the oral presentation. The course assessment is completed with the evaluation of the practical exercises done along the course, that account for another 30% of the total course grading.

Except when expressly noticed, all the evaluation activities (report and oral presentation of the semester project, as well as practical exercises) have to carried out individually.

Time assigned to each evaluation activity includes the time spent in making all the material evidences for evaluating each activity (e.g., writing of the report, preparing the presentation slides, etc.).

b) Evaluation schedule:

2nd semester project report: Making during all the semester. Submission at the end of semester, on April 3rd 2022.

2nd semester project oral presentation: Making during all the semester. Oral presentation at the end of semester,on April 8th 2022.

Course practical exercises: Making and submission weekly or biweekly along the semester.

c) Grade revision:

Once the grades obtained are published, students will have one week to apply for a grade revision by arranging an appointment with the corresponding teachers.

d) Procedurefor reassessment:

2nd semester project report: It could be reassessed in the following two weeks after the submission date scheduled. Reassessment will require the submission of a new whole report in case of negative evaluation of the former report submitted.

2nd semester project oral presentation It could be reassessed in the following week after the date scheduled for the oral presentation. Reassessment will require doing again the oral presentation in case of negative evaluation of the former presentation done.

Course practical exercises: Can not be reassessed.

To have right to a reassessment the student will have to have been previously evaluated in a set of activities that account for at least two thirds of the total course grading. Therefore he or she will have to have been evaluated of the 1st semester project report (40%) and of the 1st semester project oral presentation (30%) in the dates scheduled.

The right to a reassessment will only be granted to students that, having not passed the course (e.g., having a total course grade below 5 over 10), had obtained at least a total course grade above 3,5 over 10.

e) Conditions for a 'Not assessable' grade:

Students will receive the grade 'Not assessable' instead of 'Fail' if they had not submitted neither the 2nd semester project report nor donethe2nd semester project oral presentation. That is, if they only submit all or part of the course practical exercises.

f) UAB regulations on plagiarism and other irregularities in the assessment process:

In the event of a student committing any irregularity that may lead to a significant variation in the grade awarded to an assessment activity, the student will be given a zero for this activity, regardless of any disciplinary process that may take place. In the event of several irregularities in assessment activities of the same subject, the student will be given a zero as the final grade for this subject..

Assessment acitivities with a zero grade because of irregularities can not be reassessed.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Oral presentations	25	9	0.36	1, 2, 9, 8, 12, 15, 14, 13, 4
Practical exercises	30	9	0.36	8, 6, 7, 11, 12, 5, 14
Report submissions	45	12	0.48	1, 2, 3, 9, 8, 6, 7, 10, 11, 5, 15, 13

Bibliography

James B. Campbell ; *Introduction to Remote Sensing*, 5a edició ISBN-10: 160918176X Data original 1987

Carol L. Stimmel, 2016; *Building smart cities analytics, ICT, and design thinking*. Boca Raton: CRC Press, Taylor & Francis Group.

Deren Li, Jie Shan, Jianya Gong ed, 2009: *Geospatial technology for earth observation*.

Stone, Brian, 2012; *The City and the coming climate : climate change in the places we live*. Ed. Cambridge University Press.

Oriol Nel·lo et al, 2016 ; *La luz de la ciudad. El proceso de urbanización en España a partir de las imágenes nocturnas de la Tierra*. ISBN 978-84-617-6386-3

Oriol Nel·lo and Renata Mele, 2016; *Cities in the 21st, Century.* Nova York, Routledge, 2016 ISBN-10: 1138119644

David Harvey, 1996; *Justice, Nature and the Geography of Difference*, Wiley-Blackwell ISBN: 978-1-55786-681-3

M. Netzband et al., 2007; *Applied Remote Sensing for Urban Planning, Governace and Sustainability*. Berlin Heidelberg: Springer--Verlag.

Software

ArcGis

Qgis