480171 - XCSE - Complex and Socio-Environmental Networks

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 724 - MMT - Department of Heat Engines
Academic year: 2019
Degree: MASTER'S DEGREE IN SUSTAINABILITY (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN SUSTAINABILITY SCIENCE AND TECHNOLOGY (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5  Teaching languages: Spanish, English

Teaching staff
Coordinator: MARTI ROSAS CASALS

Degree competences to which the subject contributes

Specific:
1. The ability to design, develop, apply and assess conceptual frameworks, methods and techniques for modelling, simulating and assessing socio-environmental systems using complex networks, intelligent decision-making support systems and continuous models, for the promotion of sustainable development and sustainability.

Transversal:
2. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
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Teaching methodology

The following teaching methods will be used in the development of the course:

Lecture or conference (EXP): Sharing knowledge through lectures by professors or by external guest speakers.
Problem solving and case studies (RP): group decision exercises, debates and group dynamics, with the teacher and students in the classroom; class presentation of an activity carried out individually or in small groups.
Carry out a project, activity or work of reduced scope (PR): to carry out, individually or in a group, of a homework assignment of reduced complexity or scope, applying knowledge and presenting results.
Evaluation Activities (EV).

Training activities:

The following training activities will be used in the development of the course:

Face-to-face
Theoretical classes and conferences (CTC): knowledge, understanding and synthesis of contents presented by the lecturer (professor) or by guest speakers.
Practical classes (CP): participation in group exercises, as well as discussions and group dynamics, with the teacher and other students in the classroom.
Presentations (PS): class presentations of an activity carried out individually or in small groups.
Theoretical/practical work tutorials (TD): carry out in the class an activity or exercise, theoretical or practical in nature, individually or in small groups, with the advice of the professor.

Remote
Carry out a project, activity or work of reduced scope (PR): to carry out, individually or in a group, of a homework assignment of reduced complexity or scope, applying knowledge and presenting results.
Autonomous study (EA): study or development of the subject individually or in groups, understanding, assimilating, analysing and synthesising knowledge.

Learning objectives of the subject

At the end of the course, each student should be able to:

Understand the structure and evolution of networks, drawing on knowledge from disciplines as diverse as sociology, ecology, mathematics, computer science, economics and physics.
Apply analytical tools to characterize the structure of social and ecological networks as well as to modelling their dynamic behaviour and interactions.
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Study load

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 125h</td>
<td>40h</td>
<td>0h</td>
<td>0h</td>
<td>5h</td>
<td>80h</td>
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Total learning time: 125h

Hours large group: 40h (32.00%)

Hours medium group: 0h (0.00%)

Hours small group: 0h (0.00%)

Guided activities: 5h (4.00%)

Self study: 80h (64.00%)

Content

1. Networks and complexity

Degree competences to which the content contributes:

2. The empirical study of networks

Degree competences to which the content contributes:

3. Fundamentals of network theory

Degree competences to which the content contributes:

4. Introduction to computational algorithms

Degree competences to which the content contributes:

5. Models

Degree competences to which the content contributes:

6. Dynamic processes in networks

Degree competences to which the content contributes:
Planning of activities

A1. COMMENTS ON VIDEO "HOW KEVIN BACON CURED CANCER"

A2. SELECT A NETWORK AND VISUALIZE IT

Description:
Select a real network, which will be studied further on, and visualize it with some computer application.

Support materials:
- Pajek (http://pajek.imfm.si/doku.php)
- NodeXL (http://nodexl.codeplex.com/)
- Gephi (https://gephi.org/)

Descriptions of the assignments due and their relation to the assessment:
One (or several) image(s) of the network under study, in JPG, PNG, TIFF, etc.

Specific objectives:
- Be familiar with a computer program aimed at visualizing and analysing networks.
- Recognize the many difficulties related with the data needed to reproduce the structure of a network of any kind.

A3. BASIC MEASURES AND METRICS

A4. MODELS OF NETWORKS

A5. NETWORKS AND PANDEMICS

Qualification system

EV1: Written test (PE). 35%
EV2: Written test (PE). 35%
EV3: Individual or group coursework (TR). This includes results and reports and their oral presentation. 30%
Bibliography

Basic:


Complementary: