



POLITÉCNICA

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informáticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

103000867 - Open Data And Knowledge Graphs

### DEGREE PROGRAMME

10AZ - Master Universitario En Innovación Digital

### ACADEMIC YEAR & SEMESTER

2024/25 - Semester 1

## Index

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### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	7
8. Teaching resources.....	9
9. Other information.....	9

## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	103000867 - Open Data And Knowledge Graphs
<b>No of credits</b>	4.5 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AZ - Master Universitario en Innovación Digital
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2024-25

## 2. Faculty

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### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Oscar Corcho Garcia (Subject coordinator)	2209	oscar.corcho@upm.es	Sin horario.
Raul Garcia Castro	2110	r.garcia@upm.es	Sin horario.

\* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

## 3. Prior knowledge recommended to take the subject

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### 3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

### 3.2. Other recommended learning outcomes

- Basic knowledge about Web technologies
- Basic knowledge about database modelling
- Basic knowledge about knowledge representation techniques

## 4. Skills and learning outcomes \*

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### 4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CE-CD06 - Capacidad para extraer, integrar y consultar datos heterogéneos en diferentes escenarios

CG03 - La capacidad de usar la lengua inglesa de manera competente, es decir, con capacitación para tareas complejas de trabajo y estudio.

CG07 - Capacidad de trabajar y comunicarse también en contextos internacionales.

## 4.2. Learning outcomes

RA70 - Manage bibliographic sources in the domain, including manuals, online documentation and scientific papers

RA71 - Identify and solve those types of real-world problems in which Open Data and Knowledge Graph technologies can be successfully applied

RA72 - Use different languages, techniques, methods and methodologies that enable the development of ontologies and data for Knowledge Graphs

RA69 - Develop ontologies that serve as vocabularies for the data available on Knowledge Graphs

RA73 - Generate data in the format used for Open Data and Knowledge Graphs, and to publish them for the use of third parties

RA74 - Develop applications that exploit the (open) data available on Knowledge Graphs

\* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

## 5. Brief description of the subject and syllabus

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### 5.1. Brief description of the subject

During this course you will learn about the main foundations for Knowledge Graphs, including the W3C recommendations that are applicable in this area (RDF, RDF Schema, SPARQL, OWL, SHACL) and methodologies for the generation and publication of Knowledge Graphs from multiple heterogeneous data sources and formats, using Linked Data technologies. You will also learn about how to create shared agreed vocabularies and ontologies that can give support to Knowledge Graph generation and publication, and will understand how these principles and approaches have been applied to several domains. You will work on a practical hands-on exercise that will be the basis for your participation in hackatons and other similar events.

## 5.2. Syllabus

1. Introduction to Open Data and Knowledge Graphs
2. Data and knowledge representation and access for Open Data and Knowledge Graphs
  - 2.1. Basic Overview on Knowledge Representation
  - 2.2. RDF and RDF Schema
  - 2.3. SPARQL
3. Knowledge Graph generation, linking and publication from heterogeneous data sources
  - 3.1. Methodological guidelines for Knowledge Graph generation
  - 3.2. RDF generation from relational databases
  - 3.3. RDF generation from semi-structured data sources
  - 3.4. RDF generation using declarative mappings
  - 3.5. Data linking
  - 3.6. Knowledge Graph publication as Linked Data
4. Understanding and using relevant Knowledge Graphs
  - 4.1. Relevant Knowledge Graphs
  - 4.2. Knowledge Graph exploitation
5. Advanced topics in Knowledge Graphs
  - 5.1. Knowledge Graph quality
  - 5.2. Knowledge Graph embeddings
  - 5.3. Knowledge Graph toolkits

## 6. Schedule

### 6.1. Subject schedule\*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	<b>Unit 1</b> Duration: 00:30 Lecture  <b>Unit 2</b> Duration: 03:30 Laboratory assignments			
2	<b>Unit 2</b> Duration: 00:30 Lecture  <b>Unit 2</b> Duration: 03:30 Laboratory assignments			
3	<b>Unit 2</b> Duration: 00:30 Lecture  <b>Units 2 and 3</b> Duration: 03:30 Laboratory assignments			<b>SPARQL test</b> Problem-solving test Progressive assessment Not Presential Duration: 01:00
4	<b>Unit 3</b> Duration: 00:30 Lecture  <b>Unit 3</b> Duration: 03:30 Laboratory assignments			
5	<b>Unit 3</b> Duration: 00:30 Lecture  <b>Unit 3</b> Duration: 01:30 Laboratory assignments			
6	<b>Unit 3</b> Duration: 00:30 Lecture  <b>Unit 3</b> Duration: 03:30 Laboratory assignments			<b>RDF Generation</b> Group work Progressive assessment Not Presential Duration: 10:00

7	<b>Unit 3</b> Duration: 00:30 Lecture  <b>Units 3 and 4</b> Duration: 03:30 Laboratory assignments			
8	<b>Unit 4</b> Duration: 00:30 Lecture  <b>Unit 4</b> Duration: 01:30 Laboratory assignments			<b>RDF generation and linking based on existing ontologies and Knowledge Graphs</b> Group work Progressive assessment Not Presential Duration: 10:00
9	<b>Unit 5</b> Duration: 00:30 Lecture  <b>Unit 5</b> Duration: 03:30 Laboratory assignments			
10	<b>Unit 5</b> Duration: 00:30 Lecture  <b>Unit 5</b> Duration: 03:30 Laboratory assignments  <b>Oral presentation</b> Duration: 02:00 Additional activities			<b>Knowledge-Graph based application development</b> Group work Progressive assessment Not Presential Duration: 10:00  <b>Oral presentation</b> Group presentation Progressive assessment Presential Duration: 02:00
11				
12				
13				
14				
15				
16				
17				<b>Global exam about course contents</b> Problem-solving test Global examination Presential Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	SPARQL test	Problem-solving test	No Presential	01:00	10%	/ 10	CE-CD06 CB07
6	RDF Generation	Group work	No Presential	10:00	25%	/ 10	CB07 CE-CD06
8	RDF generation and linking based on existing ontologies and Knowledge Graphs	Group work	No Presential	10:00	15%	/ 10	CG07 CE-CD06 CB07
10	Knowledge-Graph based application development	Group work	No Presential	10:00	25%	/ 10	CB06 CB07 CG07 CE-CD06
10	Oral presentation	Group presentation	Face-to-face	02:00	25%	/ 10	CB07 CB06 CG03 CG07

#### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Global exam about course contents	Problem-solving test	Face-to-face	02:00	100%	5 / 10	CB07 CB06 CG03 CG07 CE-CD06

#### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
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Global exam about the course contents	Problem-solving test	Face-to-face	02:00	100%	5 / 10	CB06 CB07 CG03 CG07 CE-CD06
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## 7.2. Assessment criteria

The final grade will be based on the evaluation of:

1. The material provided by the student and the interaction on the repository of the course in relation with the work proposed in units 2 and 3. This work will have the weight of 35% (10% for the SPARQL test and 25% for the initial generation of RDF)
2. The material provided by the student and the interaction on the repository of the course in relation with the work proposed in unit 4. This work will have the weight of 15%.
3. The material provided by the student and the interaction on the repository of the course in relation with the work proposed in unit 5. This work will have the weight of 25%.
4. The oral presentation of the complete work. This work will have the weight of 25%.

All this will be evaluated continuously and in the final evaluation activity on the last week of the course. There will be also tests before each lecture so as to ensure that all individual students get enough knowledge about the course topics, even if most of the evaluations are done on groupwork. If the student does not pass this individual exam, he/she will need to do the final exam. There will be also short tests associated to each hands-on delivery so as to ensure as well that the students are knowledgeable about all the work that is being done in groups.

## 8. Teaching resources

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### 8.1. Teaching resources for the subject

Name	Type	Notes
The Web of Data	Bibliography	The Web of Data (2020) Aidan Hogan. <a href="https://www.springer.com/gp/book/9783030515799">https://www.springer.com/gp/book/9783030515799</a>
Ontological Engineering	Bibliography	Ontological Engineering. Gómez-Pérez A, Fernández-López M, Corcho O (2004). Springer-Verlag. <a href="http://www.springer.com/gp/book/9781852335519">http://www.springer.com/gp/book/9781852335519</a>
Linked Data applications in Spain	Web resource	<a href="http://www.linkeddata.es/">http://www.linkeddata.es/</a>

## 9. Other information

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### 9.1. Other information about the subject

The course will be taught in an intensive manner during the first 10 weeks of the course, so that those students following the continuous evaluation model will have already finished, if successful, by the end of week 10. The course materials will be made available in Moodle. The delivery of all practical work will be done using a GitHub repository.

This course does not contribute explicitly to any SDG, although the application of open data and knowledge graphs to public administrations can be categorised as contributing to SDG16.