INSTITUTION	NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS					
SCHOOL	SCHOOL OF SCIENCE					
DEPARTMENT	INFORMATICS AND TELECOMMUNICATIONS					
COURSE LEVEL	GRADUATE					
COURSE TITLE	**Knowledge Technologies**					
COURSE CODE	**C11**		**Semester**	**FALL**	**ECTS**	**6**
TEACHING HOURS per week	**THEORY**	**3**	**SEMINAR.**	**0**	**LABORATORY**	**1**
URL	**http://cgi.di.uoa.gr/~pms509/index.html**					

COURSE CONTENT
Introduction to Knowledge Graphs, the Semantic Web and Linked Data
The Resource Description Framework (RDF, RDFS, RDF*)
Shapes Constraint Language (SHACL)
The query language SPARQL, SPARQL Formalization
Description logics, tableaux techniques
The Web Ontology Language (OWL), OWL2
Ontology Engineering
Rule languages for the Semantic Web
A Data Science Pipeline for Big Linked Earth Observation Data, Discovering Earth Observation Data
Linked spatial and temporal data. Spatial and temporal extensions to RDF and SPARQL
Transforming geospatial data into RDF
YAGO2geo & Geospatial Question Answering

STUDENT LEARNING OBJECTIVES
Upon successful completion of the course the student will be able to: • Explain the notions of Knowledge Graph and ontology • Develop, in an efficient way, ontologies using RDF, RDF*, RDFS, SHACL, OWL, OWL2, SWRL, basic Description Logic languages • Formulate SPARQL/GeoSPARQL queries over a KB/KG and to be able to demonstrate the underpinning reasoning mechanism resulting the answer • Prove formally concept/ABox/KB satisfiability by using tableaux techniques • Utilize the spatiotemporal RDF store Strabon to query geospatial data, the GeoTriples tool to automatically transform shapefiles to RDF, and Sextant to create maps of various layers using GeoSPARQL • Discuss the research challenges in geospatial question answering and the main approaching methods

TEACHING AND LEARNING METHODS – ASSESSMENT	
TEACHING METHOD	In Class with slides and whiteboard for examples and exercises of the course (if the pandemic restrictions allow it, otherwise virtually).

	In Tutorials with demonstration of the various tools required for the assignments
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	Learning process supported by the e-class platform. Email communication Learning process supported by web page, providing homeworks, tutorials, reading material Live transmission of lectures (*if the course is taught virtually*) Ability to track recorded lectures Recording of lectures for offline study Interaction and support forum on the Piazza platform
TEACHING ORGANIZATION *Describe in detail the way and methods of teaching:* *Enhanced Lectures,* *Online Lectures,* *Seminars,* *Tutorial,* *Laboratory,* *Laboratory Exercise,* *Study & analysis of literature,* *Practice (Positioning),* *Interactive teaching,* *Developing a project,* *Individual / group work* *Telework (reference to tools) etc.* *Details of the student's study hours for each learning activity and hours of non-guided study are shown to ensure that the total workload at the semester corresponds to the ECTS*	**Activity** / ***Student Workload*** *(hours)* Lectures/ Interactive teaching: 39 Tutorial: 13 Homework and Project: 98 ***Total Course (25 hours of workload per unit of credit)***: ***150***
ASSESSMENT OF STUDENTS *Description of the assessment process* *Assessment Methods, Formative or Concluding, Multiple Choice Test, Quick Response Questions, Test Development Questions, Problem Solving, Written Work, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Other / Other* *Fully defined evaluation criteria are mentioned and if and where they are accessible to students.*	2 assignments with theoretical and implementation questions. 1 programming project. **Assessment methods** / ***Number*** / ***Percentage*** Assignments: 2: 70% Project: 1: 30%

LITERATURE AND STUDY MATERIALS / READING LIST
Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph. Foundations of Semantic Web Technologies. Chapman & Hall/CRC, 2009 Grigoris Antoniou and F. van Harmelen. A Semantic Web Primer. MIT Press , 2004. Franz Baader, Diego Calvanese, Deborah McGuinness, Daniele Nardi and Peter Patel-Schneider. The Description Logic Handbook: Theory, implementation and applications. Other Resources: Rudolph S. (2011) Foundations of Description Logics. In: Polleres A. et al. (eds) Reasoning Web. Semantic Technologies for the Web of Data. Reasoning Web 2011. Lecture Notes in Computer Science, vol 6848. Springer, Berlin, Heidelberg. Tom Heath and Christian Bizer. Linked Data: Evolving the Web into a Global Data Space (1st edition). Synthesis Lectures on the Semantic Web: Theory and Technology, 1:1, 1-136. Morgan & Claypool, 2011. Book website

Glen Hart and Catherine Dolbear. Linked Data: A Geographic Perspective. CRC Press, 2013. Book website

Dean Allemang and James Hendler. SEMANTIC WEB FOR THE WORKING ONTOLOGIST: Effective Modeling in RDFS and OWL. Elsevier Science & Technology Books, May 2008. Book website

Heiner Stuckenschmidt and Frank van Harmelen. Information Sharing on the Semantic Web. Springer, 2005.

Asunción Gomez-Perez, Mariano Fernandez-Lopez and Oscar Corcho. Ontological Engineering: With Examples from the Areas of Knowledge Management, E-Commerce and the Semantic Web, 2nd edition, Springer, 2007.

John Davies, Dieter Fensel, Frank van Harmelen and Frank van Harmelen (editors). Towards the Semantic Web: Ontology-Driven Knowledge Management. John-Wiley, 2003.

John Davies, Rudi Studer and Paul Warren (editors). Semantic Web Technologies: Trends and Research in Ontology-based Systems: Trends and Research. John-Wiley, 2006.

Franz Baader, Diego Calvanese, Deborah McGuinness, Daniele Nardi and Peter Patel-Schneider. The Description Logic Handbook: Theory, implementation and applications. Publicly available at the following page: http://www.inf.unibz.it/~franconi/dl/course/dlhb/home.html .
Related papers and journals, particularly from the top conferences in this area
International Semantic Web Conference (http://iswc.semanticweb.org/)
Extended Semantic Web Conference (https://www.eswc-conferences.org/)
International World Wide Web Conference (http://www.w3.org/Conferences/Overview-WWW)

Relevant websites, e.g., https://www.w3.org/standards/semanticweb/ (The W3C Activity on the Semantic Web).