Doctoral School
Warsaw University of Technology

COURSE OFFERED IN THE DOCTORAL SCHOOL

Code of the course	4606-EW-0000000-0373	Name of the course	Polish	**Porządkowanie wiedzy dziedzinowej przy pomocy ontologii**	
			English	**Organizing domain-specific knowledge with ontologies**	
Type of the course	~~r~~esearcher's workshop				
Course coordinator	Prof. dr hab. Piotr Kulicki		Course teacher	Prof. dr hab. Piotr Kulicki	
Implementing unit	Wydział Administracji I Nauk Społecznych	Scientific discipline / disciplines*			
Level of education	doctoral studies	Semester	winter		
Language of the course	English				
Type of assessment	grade	Number of hours in a semester	30	ECTS credits	2
Minimum number of participants	10	Maximum number of participants	24	Available for students (BSc, MSc)	Yes

Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week	2		2		
	in a semester	20		10		

* does not apply to the Researcher's Workshop

1. Prerequisites

Good command of scientific English. General interest in issues of a philosophical nature, particularly in conceptual analysis and ontology

2. Course objectives

The course aims to introduce doctoral students to the theoretical foundations and practical methods of organizing domain-specific knowledge using ontologies and Semantic Web technologies. Students will become familiar with selected foundational ontologies and learn how to apply ontological analysis to their own research domains. The course develops the ability to analyze conceptual structures of scientific and technical fields, design formal ontological models, and implement them using contemporary ontology engineering tools and standards, preparing students to apply ontologies in interdisciplinary research, knowledge integration, explainable AI, and advanced information systems.

3. Course content (separate for each type of classes)

Lecture

1. Introduction to knowledge organization and ontologies
2. Philosophical and logical foundations of ontological knowledge representation
3. Semantic web technologies: RDF, RDFS, OWL, and SPARQL
4. Foundational ontologies: DOLCE and BFO
5. Ontology Modeling in OWL Using Protégé
6. Ontology Validation, Reasoning, and Semantic Consistency
7. Applications of Ontologies in AI, Science, Engineering, and Information Systems
8. Using LLMs in ontology design and application

Project classes

The project classes are devoted to the development and presentation of individual ontology projects related to the participants' doctoral research areas. Each student selects a fragment of their scientific domain and performs a basic ontological analysis, identifying relevant concepts, relations, processes, and constraints. The outcome of the project is a formal ontology model implemented using selected ontology engineering tools and presented

together with a discussion of its possible applications, conceptual assumptions, and methodological challenges.

4. Learning outcomes			
Type of learning outcomes	Learning outcomes description	Reference to the learning outcomes of the WUT DS	Learning outcomes verification methods*
Knowledge			
W01	Know key concepts of knowledge representation and conceptual structures used in different domains	SD_W2, SD_W3	active participation during classes, project evaluation, test
W02	Understand the conceptual structure of their own discipline within a certain paradigm and the conceptual differences between the paradigms	SD_W2, SD_W3	project evaluation, test
Skills			
U01	Identify concepts, relations, processes, and constraints occurring within the modeled domain	SD_U1, SD_U2, SD_U4	active participation during classes, project evaluation, test
U02	Design and implement domain ontologies using tools such as Protégé;	SD_U1, SD_U2, SD_U4	project evaluation
U03	Use ontology tools to present backgrouund knowledge of their research	SD_U1, SD_U2, SD_U4	active participation during classes, project evaluation
U04	Use ontology tools to communicate within an interdisciplinary research group	SD_U1, SD_U2, SD_U4	active participation during classes, project evaluation
Social competences			
K01	Critically evaluate conceptual structures used in scientific research and information systems;	SD_K1	active participation during classes, project evaluation
K02	Creatively apply knowledge representation methods responsibly in scientific research and artificial intelligence applications;	SD_K4	active participation during classes, project evaluation

*Allowed learning outcomes verification methods: exam; oral exam; written test; oral test; project evaluation; report evaluation; presentation evaluation; active participation during classes; homework; tests

5. Assessment criteria
Evaluation: project (50%), test (25%), and active participation (25%) during the classes are going to be evaluated.

6. Literature
Primary references:
[1] Staab, S., & Studer, R. (Eds.). (2009). Handbook on Ontologies. Springer.
[2] Gómez-Pérez, A., Fernández-López, M., & Corcho, O. (2004). Ontological Engineering. Springer

[3] Arp, R., Smith, B., & Spear, A. D. (2015). Building Ontologies with Basic Formal Ontology. MIT Press.

[4] Gangemi, A., Guarino, N., Masolo, C., Oltramari, A., & Schneider, L. (2002). Sweetening ontologies with DOLCE. In A. Gómez-Pérez & V. R. Benjamins (Eds.), Knowledge Engineering and Knowledge Management: Ontologies and the Semantic Web (pp. 166–181). Springer.

Secondary references:

[1] Smith, B. (2003).Ontology. In L. Floridi (Ed.), Blackwell Guide to the Philosophy of Computing and Information. Blackwell.

[2] Roberto Poli, Healy, M., & Kameas, A. (Eds.). (2010). Theory and Applications of Ontology: Philosophical Perspectives. Springer.

7. PhD student's workload necessary to achieve the learning outcomes**		
No.	Description	Number of hours
1	Hours of scheduled instruction given by the academic teacher in the classroom	30
2	Hours of consultations with the academic teacher, exams, tests, etc.	5
3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	20
4	Amount of time devoted to the preparation for exams, test, assessments	5
	Total number of hours	**60**
	ECTS credits	**2**

** 1 ECTS = 25-30 hours of the PhD students work (2 ECTS = 60 hours; 4 ECTS = 110 hours, etc.)

8. Additional information	
Number of ECTS credits for classes requiring direct participation of academic teachers	2
Number of ECTS credits earned by a student in a practical course	2