DOCTORAL (PHD) STUDIES

COURSE UNIT DESCRIPTION

Course unit title	Scientific areas	Faculty	Institute, department
Systems analysis technologies of informatics engineering	Informatics Engineering (T 007)	Faculty of Mathematics and Informatics	Institute of Data Science and Digital Technologies

Study method	Number of credits	Study method	Number of credits
Lectures	1	Consultations	1
Individual works	4	Seminars	1

Summary

Necessary preparation. The module's studies require knowledge of the master's level computer science and mathematics courses offered to the students of informatics specialties.

The aim of the course is to deepen knowledge about modeling and metamodeling of complex systems – cyber-social (organizational) systems (CSS) and cyber-physical system (CPS)s.

Main topics:

• Systems Analysis Methodology: Systems Development Cycles, RUP Model, J.Zachman ISA Framework, OMG MDA, MDE, Domain Knowledge Based IS Design. Cybernetics: Features of the 1st, 2nd, 3rd and 4th order cybernetics.

• Modeling notation: DFD, UML, IDEF, SysML, BPMN, DMN, SBVR. Transactional workflows. ACTION method. Modeling and metamodeling of CPS and CSS. Process coordination models. Modeling of business rules. Enterprise modeling standards and languages: ENV 12204, EPC (ARIS), BPMN, DMN, UML, SysML, UEML. Autonomic computing systems. Simulation of cyber-physics systems (KFS): solid models, discrete and hybrid models. KFS cloud modeling. Calculating models. Process model normalization.

• Practical systems analysis methods and languages, their classification. Structural-functional analysis. Object oriented system analysis. EPC methodology (Event-Process Chain). Goal-based analysis and design - GORE methodology. Goal modeling. KAOS method. Goal model decomposition in the Process Space.

• Data mining methods. Data Cubes.

Process mining methods. Process cubes. Process mining tools: PROM, DISCO, bupaR, Celonis and others.

• Modeling tools: CASE system architecture, CASE packages Magic Draw, Provision Workbench, Enterprise Architect, System Architect, ARIS.

• System systems development frameworks DODAF, MODAF, TOGAF, UAF and UPDM for large systems development.

Practical assignments: a report on specific systems analysis methods and program packages related to the topic of the dissertation.

Main literature

Saulius Gudas (2012). Foundations of the Information Systems Engineering Theory. Monograph, Vilnius, Vilniaus universiteto leidykla, 2012, 382 p. ISBN978-609-459-075-7

Gudas, S.; Valatavičius, A. Extending model-driven development process with causal modeling approach // Data science: new issues, challenges and applications / Dzemyda, Gintautas, Bernatavičienė, Jolita, Kacprzyk, Janusz (Eds.). Cham: Springer, 2020. ISBN 9783030392499. eISBN 9783030392505. p. 111-143. (Studies in Computational Intelligence, ISSN 1860-949X, eISSN 1860-9503 ; vol. 869). DOI: 10.1007/978-3-030-39250-5_7.

Dietz, Jan L.G 1.Enterprise Ontology Theory and Methodology, 2006, XIV, 244 p., ISBN: 978-3-540-29169-5

Jaap Schekkerman How to survive in the jungle of Enterprise Architecture Frameworks, Trafford, 2003, ISBN 1-4120-1607-x (p.5 - p.100)
Derler, P., Lee, E.A., Sangiovanni-Vincentelli, A. Modeling Cyber-Physical Systems. Vol. 100, No. 1, January 2012 ,Proceedings of the IEEE, 2012
P. Hehenberger and et al. Design, modelling, simulation and integration of cyber physical systems: Methods and applications. Computers in Industry 82 (2016) 273–289
Estefan, Jeff A. "Survey of model-based systems engineering (MBSE) methodologies." Incose MBSE Focus Group 25 (2007): 8.

Lecturer(s) (name, surname)	Science degree	Main publications
Saulius Gudas	Dr.	http://www.elaba.mb.vu.lt/dmsti/?aut=Saulius+Gudas
Audrius Lopata	Dr.	https://www.researchgate.net/profile/Audrius-Lopata/research
Audronė Lupeikienė	Dr.	http://www.elaba.mb.vu.lt/dmsti/?aut=Audronė+Lupeikienė