UNIVERSITY OF DEBRECEN Doctoral School of Informatics

Complex exam minor subject	Automata and formal languages
Syllabus	 Elements of formal languages, operations over formal languages, generative grammars, Chomsky hierarchy. Derivation tree, Bar-Hillel lemma, pumping lemma for regular languages. Main types of automata: finite automata, pushdown automata, Turing machine and linear bounded automata. Finite transducers, Mealy automata, Moore automata. Equivalences between automata and grammars. Normal forms: Chomsky normal form, Kuroda normal form, Révész normal form. Parsing, Early algorithm, CYK algorithm. Nondeterministic and deterministic automata, similarities, differences. Closure properties of language classes. The word problem for different languages classes. Church-Turing thesis. Automata networks. Membrane computing.
Bibliography	 Pál Dömösi and Chrystopher L. Nehaniv: Algebraic Theory of Automata Networks. An Introduction. Siam, 2005. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman: Introduction to Automata Theory, Languages and Computation (3rd edition). Addison-Wesley, 2006. Michael Sipser: Introduction to the Theory of Computation (3rd edition). Cengage Learning, 2013. Géza Horváth and Benedek Nagy: Formal Languages and Automata Theory. Typotex, 2014.
Compulsory subjects for this minor subject	 Automata and Languages Context-free Languages Context-sensitive Languages Pushdown Automata
Recommended subjects for this minor subject	 Theory of computability and its applications in logic Automata Networks Introduction to Membrane Computing

Introduction to Membrane Computing
 Combinatorial Properties of Formal Languages