SYLLABUS

Name: ***Formal Languages (MakAu-DS>SM1FL19)***
Name in Polish:
Name in English: ***Formal Languages***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Course homepage:

https://platforma2.polsl.pl/rau2/course/view.php?id=883

Description:

The course focuses on regular and context-free languages for data analysis. The course covers regular languages (regular expressions, finite state automata, Kleene's theorem, pumping lemma for regular languages) and context-free languages (grammars, LL(1), SLR, LR(1), and LALR analysers). Laboratories are dedicated to analysis of data with regular languages and context-free languages.

ECTS:2
classes:
* total workload: 60 h (30 contact hours + 30 h student's work
* lecture 15 h
* laboratory 15 h

Student's work: preparation for laboratory and the final test.

The course develops practical skills.
The course develops engineering competences.
Przedmiot kształtuje umiejętności praktyczne.
Przedmiot kształtuje kompetencje inżynierskie.

Lecture:
1. formal languages, classification of languages
2. regular languages: finite automata (deterministic and nondeterministic, determinization, optimization, Thompson's algorithm)
3. regula languages: derivative of regular expressions + pumping lemma for regular languages
4. grammars, top-down analysis of context-free languages: LL(1)
5. bottom-up analysis of context-free languages: SLR
6. bottom-up analysis of context-free languages: LR(1)
7. bottom-up analysis of context-free languages: LALR

laboratory:
1. (flex) regular expressions
2. (flex) buffers and states of the flex analyser
3. (yacc) collaboration of flex and yacc, definition of tokens and grammar
4. (yacc) priority of operators, recursion
5. (yacc) unions: definition, types for tokens and nonterminals
6. (yacc) error handling

Sylabus obowiązuje od roku akademickiego 2025/26 a jego zawartość nie podlega zmianom w trakcie trwania semestru.

Bibliography:

J. Hopcroft, R. Motwani, J. Ullman, “Introduction to automata theory, languages, and computation”
A. Aho, R. Sethi, J. Ullman, “Compilers – principles, techniques, and tools”
B. Melichar, J. Janoušek, L. Vagner, “Parsing and translating”
E. Šestáková, “Automata and grammars: a collection of exercises and solutions”

Learning outcomes:

knowledge:
EU_W1 A student knows the idea, classification, and notions in formal languages. (K2A_W02, K2A_W05)
EU_W2 A student knows the Kleene's theorem for regular languages. (K2A_W02, K2A_W05)
EU_W3 A student understands finite automata and their properties. (K2A_W02, K2A_W05)
EU_W4 A student knows the properties of context-free languages and their applications. (K2A_W02, K2A_W05)
EU_W5 A student knows the algorithms for parsing context-free languages. (K2A_W02, K2A_W05)

skills:
EU_U1 A student can express a regular language with a regular expression. (K2A_W02, K2A_W05, K2A_U01)
EU_U2 A student can construct and finite automaton for a regular language. (K2A_W02, K2A_W05, K2A_U01)
EU_U3 A student can model a context-free language with a grammar. (K2A_W02, K2A_W05, K2A_U01)
EU_U4 A student can construct an LL parser for a context-free language. (K2A_W02, K2A_W05, K2A_U01)
EU_U5 A student can construct an LR parser for a context-free language. (K2A_W02, K2A_W05, K2A_U01)

Assessment methods and assessment criteria:

Grading:
1. Students have to pass both lab test and lecture test.
2. A positive grade in the lab test implies 3.0 in the lecture test.
3. A student can take the lecture test for a higher grade.
4. Final grade is a mean of lab and lecture grades if both are positive, otherwise it is 2.0 (negative).

The syllabus is valid from academic year 2025/26 and its contents cannot be changed during the semester.

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	2	2020/2021-L	