CMPE/CMSE-471 Automata Theory

Department: Computer Engineering

Instructor Information
Name: Prof. Dr. Muhammed Salamah
E-mail: muhammed.salamah@emu.edu.tr
Office: CMPE 114
Office Tel: 1149

Assistant Information
Name: Ebtihal Enfes
Office: CMPE123
Office Tel: 2839

Meeting times and places
Monday 08:30-10:20, Room CMPE 026
Thursday 14:30-16:20, Room CMPE 026
Tuesday 14:30-16:20, Room CMPE 026 (Tutorial)

Program Name: Computer Engineering / Software Engineering	**Program Code:** 25/29

Course Number:	**Credits:**	**Year/Semester:**
CMPE471/CMSE471	4 Cr	2024-2025 Spring

☒ Required Course ☐ Elective Course (click on and check the appropriate box)

Prerequisite(s):
MATH163 Discrete Mathematics

Catalog Description:
Introduction to formal languages and grammars. Deterministic and non-deterministic finite automata. Regular languages. Regular expressions. Limitations of languages. Context-free grammars. Context-free languages. Pushdown automata. Parsing. Chomsky hierarchy. Unrestricted grammars. Recursive and recursively enumerable sets. Turing machines. Computability.

Course Web Page:
http://cmpe.emu.edu.tr/courses/cmpe471

Textbook(s):
J.E. Hopcroft, R. Motwani, J.D. Ullman, "Introduction to Automata Theory, Languages, and Computation", 2nd or above editions, Addison-Wesley.

Indicative Basic Reading List :

1. Straubing H., "Finite Automata, Formal Logic, and Circuit Complexity", Birkhauser, Berlin 1994.
2. McNaughton R., "Elementary Computability, Formal Languages, and Automata", Prentice-Hall, 1982
3. Kohavi, Z., "Switching and Finite Automata Theory", McGraw-Hill, 1978
4. Rayward Smith V.J., "Formal Language Theory", McGraw-Hill, 1995

Topics Covered and Class Schedule:
(4 hours of lectures per week)

Week 1	Introduction.
Week 2	Strings and Alphabets, Formal Languages, The notion of Grammar.
Week 3	Phrase Structured Grammars, Regular Grammars, Context-Free Grammars (CFG).
Week 4	Finite Automata (FA).
Week 5	Deterministic Finite Automata (DFA), The Equivalence of Nondeterministic Finite Automata (NFA) and DFA
Week 6	Regular Expressions and the Corresponding Languages.
Week 7	Properties of Languages Accepted by FA. Equivalence of FA and Regular Languages
Week 8, 9	Midterm
Week 10	The Pumping Lemma. Minimization of FA. Mealy/Moore Machines
Week 11	Properties of Context Free Languages (CFL). Derivation Trees and Ambiguity.
Week 12	Chomsky and Greibach Normal Forms.
Week 13	Equivalence of CFLs and PDAs.
Week 14	Equivalence of CFLs and PDAs.
Week 15	Revision.

Tutorial Schedule:
(2 hours of tutorial per week)

Week 3	Solving questions on Mathematical Principles, Strings and Alphabets, Formal Languages, The notion of Grammar.
Week 4	Solving questions on Context-Free Grammars (CFG).
Week 5	Solving questions on FA.
Week 6	Solving questions on NFA and DFA.
Week 7	Solving questions on Regular Expressions.
Week 10	Solving questions on Equivalence of FA and Regular Languages.
Week 11	Solving questions on Context Free Languages (CFL).
Week 12	Solving questions on Chomsky and Greibach Normal Forms.
Week 13	Solving questions on PDA.

Course Learning Outcomes:

Upon successful completion of the course, students are expected to have the following competencies:

(1) Design a finite automaton (FA) for a specified language (1,2)
(2) Design a push-down automaton (PDA) for a specified language (1,2)
(3) Convert non-deterministic automata to deterministic automata (2)
(4) Use regular expressions for specifying languages (1)
(5) Convert between regular expressions and finite automata (2)
(6) Minimize finite automata (2)
(7) Design/Use context free grammars (1,2)
(8) Put a context-free grammar into various normal forms (2)
(9) Formally describe languages generated by grammars (1)
(10) Formally describe languages accepted by finite automata (1)
(11) Formally describe languages accepted by PDA (1)
(12) Convert between context free grammars and PDA (1)

	Method	**No**	**Percentage**
Assessment	Midterm Exam	1	30 %
	Quiz #1 (20/03/25 at 14:30) Quiz #2 (22/05/25 at 14:30)	2	20 %
	Tutorials	≈ 7	5 %
	Final Examination	1	45 %

Policy on makeups: There is no makeup for the quizzes. If you miss both of the midterm and final exams, your grade will be "NG". Only one makeup exam can be given for one of the missed exams (midterm or final) according to the University regulations. In order to be able to enter a makeup exam, you MUST submit a written report to your instructor stating your excuse within 3 days of that examination.

Policy on Tutorials: Attendance is mandatory.

Contribution of Course to Criterion 5

Credit Hours for:
Mathematics & Basic Science : 0
Engineering Sciences and Design : 4
General Education : 0

Relationship of the course to Program Outcomes

The course has been designed to contribute to the following program outcomes:
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Prepared by: Prof.Dr. Muhammed Salamah	**Date Prepared:** February 24, 2025