GAU, Faculty of Engineering

Course Unit Title	Automata Theory and Formal Languages
Course Unit Code	CEN420
Type of Course Unit	Technical Elective, Computer Engineering Students
Level of Course Unit	4th Year BSc
National Credits	3
Number of ECTS Credits Allocated	6 ECTS
Theoretical (hour/week)	3
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	4
Semester when the course unit is delivered	7/8
Course Coordinator	
Name of Lecturer (s)	
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisities and co-requisities	CEN302 - Structured Programming Languages
Recommended Optional Programme Components	Basic bacground Computation and Linear Algebra

Objectives of the Course:

- Present the theory of finite automata, as the first step towards learning advanced topics, such as compiler design.
- Apply the concepts learned in fundamental courses such as Discrete Mathematics, in a theoretical setting; in particular, the application of proof techniques.
- Discussing the applications of finite automata towards text processing.
- Develop an understanding of computation, Languages and Compilers

Learning Outcomes

When this course has been completed the student should be able to		Assesment.
1	Apply a number of proof techniques to theorems in language design.	1
2	Develop a clear understanding of undecidability.	1
3	Understand the equivalence between Non-deterministic Finite State Automata and Deterministic Finite State Automata.	1
4	Understand the equivalence between Context-Free Grammars and Non-deterministic Pushdown Automata.	1
5	Appreciate the power of the Turing Machine, as an abstract automaton, that describes computation, effectively and efficiently.	1,2
6	Develop skills in compilers and programming languages	1,2

Assesment Methods: 1. Written Exam, 2. Assignment 3. Project/Report, 4.Presentation, 5 Lab. Work

Course's Contribution to Program

		CL
1	Ability to understand and apply knowledge of mathematics, science, and engineering	5
2	Ability to design and conduct experiments as well as to analyze and interpret data	1
3	Ability to work in multidisciplinary teams while exhibiting professional responsibility and ethical conduct	1
4	Ability to apply systems thinking in problem solving and system design	4
5	Knowledge of contemporary issues while continuing to engage in lifelong learning	1
6	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice	3
7	Ability to express their ideas and findings, in written and oral form	2
8	Ability to design and integrate systems, components or processes to meet desired needs within realistic constraints	2
9	Ability to approach engineering problems and effects of their possible solutions within a well structured, ethically responsible and professional manner	2
10	To apply fundamental concepts of software design, database design, data processing and artificial intelligence in the modeling, designing, implementing, testing and deploying software solutions.	3
11	Ability to analyse and design hardware systems by applying the principles of embedded systems, microprocessors, computer networks, distributed systems and data communication.	1

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate 4: High, 5:Very High)

Course Contents

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

Recommended Sources

Textbook:
J.E. Hopcroft, R. Motwani, J.D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Addison-Wesley, 3rd Edition, 2006

Supplementary Material (s):
1.Straubing H., "Finite Automata, Formal Logic, and Circuit Complexity", Birkhauser, Berlin 1994.
2. Rayward Smith V.J., "Formal Language Theory", McGraw-Hill, 1995

Assessment

Attendance	10%	Less than 25% class attendance results in NG grade.
Laboratory	-	
Midterm Exam	30%	Written Exam
Quiz	20%	Written Exam
Final Exam	40%	Written Exam
Total	100%	

ECTS Allocated Based on the Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class (including the Exam week)	15	3	45
Labs and Tutorials	-	-	-
Assignments	-	-	-
Project/Presentation/Report Writing	1	25	25
E-learning Activities	-	-	-
Quizzes	1	15	15
Midterm Examination	1	15	15
Final Examination	1	15	15
Self Study	15	4	60
Total Workload			175
Total Workload/30 (h)			5.83
ECTS Credit of the Course			6