ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY
DEPARTMENT OF SOFTWARE ENGINEERING
Course Outline

Course Title: **Formal Language and Automata Theory**
Course Number: **SE 2041(ETW)**
Course Load: **3**
Instructor: **Amdework Abebaw**
Email: **amde1815195@gmail.com**

Course Description:
This course aims to develop the theoretical foundations of computer science through study of mathematical and abstract models of computers and the theory of formal languages. It also, introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

Course Goals or Learning Outcomes:
On completion of this course students should be able to:

- Introduce concepts in automata theory and theory of computation Study the central concepts of automata theory.
- Acquire insights into the relationship among formal languages, formal grammars, and automata. Identify different formal language classes and their relationships.
- Design grammars and recognizers for different formal languages.
- Prove or disprove theorems in automata theory using its properties
- Familiar with thinking analytically and intuitively for problem solving situations in related areas of theory in computer science.

Course Contents

Chapter One **Introduction**

- Mathematical preliminaries and notations
- Alphabets and Strings
- Languages
- Grammars
- Automata

Chapter Two **Finite automata (FA)**

- DFA -Formal definition
- Simplified notations (state transition diagram, transition table), Language of a DFA.
- NFA Equivalence of DFAs and NFAs

Chapter Three **Regular expression and regular language**

- Regular expressions (RE),
- RE to FA, FA to RE,
- Applications of REs. Regular grammars and FA

- FA for regular grammar,
- Connection Between Regular Expressions and Regular Languages
- Regular grammar
- Pumping lemma and non-regular language grammars

Chapter Four **Context free languages**

- Context free languages
- Parsing and ambiguity
- sentential forms
- Leftmost and right most derivation
- Derivation tree or Parse tree
- Definition, Relationship between parse trees and derivations.

Chapter Five **Simplification of context free grammar**

- Methods for Transforming Grammars
- Normal for grammars and parsing
- Chomsky's hierarchy of grammars

Chapter Six **Pushdown automata**

- Non deterministic Pushdown Automata
- Pushdown Automata and Context-Free Languages
- Deterministic push down automata and Deterministic context free language
- Properties of context free languages

Chapter Seven **Turing Machine**

- The standard Turing machine
- Turing machine as machine accepters
- Turing machine as Transducers
- Universal Turing Machines

REFERENCE BOOKS:

1. **Fundamentals of the Theory of Computation: Principles and Practice** – Raymond Greenlaw, H.James Hoove, Morgan Kaufmann, 1998.
2. **Introduction to Languages and Automata Theory** – John C Martin, 3rd Edition, Tata McGraw-Hill, 2007.
3. **Introduction to Computer Theory** –2nd Edition, John Wiley & Sons, 2004.
4. **An Introduction to the Theory of Computer Science, Languages and Machines** –Thomas A. Sudkamp, 3rd Edition, Pearson Education, 2006.

Evaluation:

Tests:	20 %
Quizzes:	10%
Individual Assignment:	10%
Group Assignment:	10%
Final Exam:	50%