

CE5.2ALC AUTOMATA LANGUAGE AND COMPUTATION

Course Objectives: The major objective of this course is to introduce the student to the concepts of theory of computation in computer science. The student should acquire insights into the relationship amongst formal languages, formal grammars and automata.

Instructional Objective:

At the end of the course, the students would be familiar with the following:

- logic and set theory, functions and relations, formal languages and grammars
- finite-state automata, pushdown automata
- Turing machines, Church's Thesis, undecidability
- Recursively Enumerable Languages and Unsolvable Problems.

Lectures per week	:	3+0+2
Max. Marks for Theory paper	:	100
Max. Marks for Sessionals	:	20 + 5
Duration of paper	:	3 hours
Total no. of modules	:	4
No. of questions from each module	:	2
Total no. of questions to be answered	:	5

(At least one question from each module with two compulsory questions from any one module).

Module-1

Introduction (2hrs)

Sets, Logic, Functions, Relations, Languages

Proofs, Mathematical Induction, Recursive definitions, Structural Inductions

Regular Languages and Finite Automata (5hrs)

Regular Languages and Regular Expressions

The memory required to recognize a language

Finite Automata (DFA)

Distinguishing one string from another

Union, Intersection, and Complement

Nondeterministic and Kleene's theorem (5hrs)

NFA, Converting NFA to DFA, ϵ -NFA, Kleene's theorem

Converting an ϵ -NFA to an NFA

Regular Languages

Myhill-Nerode theorem

Minimal finite Automata

The pumping lemma for regular languages

Closure properties

Decision Problem

Moore and Mealy Machine

Module 2

Context –free Grammars and Push down Automata (6hrs)

Context –Free Grammars and Languages

Derivation Trees and Ambiguity

An unambiguous CFG for algebraic Expression

Simplified forms and Normal Forms – CNF, GNF

Pumping Lemma, Closure Properties

Push Down Automata (6hrs)

DPDA

PDA corresponding to a given CFG – Top-down PDA, Bottom-up PDA

CFG corresponding to a given PDA

Closure properties of CFG

Module-3

Turing Machine and their languages (12hrs)

Turing Machine Introduction

Computing a Partial function with a Turing machine

Combining Turing machine

Variations of Turing Machine

Nondeterministic Turing Machine

Universal Turing Machine

Church-Turing Thesis

Module-4

Recursively Enumerable Languages (8hrs)

Recursively Enumerable and Recursive

Enumerating a Language

General Grammars

Unrestricted Grammars and Turing Machine

Context-Sensitive Language and Grammar

Linear Bounded Automata

Chomsky Hierarchy

Unsolvable Problems (4hrs)

A non recursive language and unsolvable Decision problems

Reducing one problem to another

The halting problem

Rice's Theorem

Closure Properties of families of languages

TEXT BOOKS

1. Introduction to languages and the theory of computation, By John C. Martin, Tata McGraw Hill
2. Introduction to Automata Theory, Languages and Computation - By Hopcraft and Ullman, Narosa Publishing House.

REFERENCE BOOKS

1. Theoretical Science - By Krishnamurthy, AWEF.
2. Theory of Computer Science - By Brady, McGraw Hill.
3. Computations, Finite and Infinite Machines - By Minsky, Prentice Hall