CSH513: Theory of Computations

Teaching Scheme	Examination Scheme	
Lectures: 4 hrs/Week	Class Test	-20 Marks
Tutorials: 2 hr/Week	Teachers Assessment	– 10 Marks
	Attendance	– 20 Marks
Credits: 6	End Semester Exam	– 100 marks

Prerequisite: Sets, Relations, Trees, Graphs, Boolean Algebra etc.

Course Objectives:

1. Introduce concepts in automata theory and theory of computation.
2. Identify different formal language classes and their relationships.
3. Design grammars and recognizers for different formal languages.
4. Prove or disprove theorems in automata theory using its properties.
5. Determine the decidability and intractability of computational problems.

Detailed Syllabus:

UNIT I

Introduction: Basic Concepts: Formal proofs, Additional form of Proofs, Inductive proof, Sets, Relation, Kleen Closures, Graphs, Trees, Symbol, Alphabets, strings and languages, automata and grammar, Applications of automata theory.

UNIT – II

Finite Automata: Basic Machine and Finite State Machine. Finite Automata: Definition and Types of Automata- DFA, NFA, Construction of DFA and NFA, NFA with epsilon-Moves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA with epsilon moves to DFA, Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.

UNIT – III

Regular Expressions, Regular Grammar and Languages: Definition and Identities of Regular Expressions, regular and non-regular language, operations on RE and their precedence, Algebraic laws for RE, Regular Expression and Finite Automata, Conversion from RE to FA and DFA to RE, Arden's theorem, Pumping Lemma for RL.

UNIT – IV

Context Free Grammar and Languages: Definition and Construction of CFG, Definition and Generation of CFL from CFG, Derivation, derivation trees, Ambiguous Grammar and Removal of Ambiguity. Simplification of CFGs. Normal Forms of Grammar: CNF and GNF.

UNIT - V

Pushdown Automata: Definition of push down automata, The language of PDA, Definition and Construction of DPDA and NPDA. Equivalence of PDAs and CFGs, Closure Properties Of CFLs.

UNIT – VI

Turing Machines: Definition and Construction of Turing Machines. Languages of TM. Types of TM. Comparison And Applications of DFA, PDA and TM.

Text and Reference Books

1. John C. martin, "Introduction to Language and Theory of Computation", TMH, Third Edition.
2. Michel Sipser "Introduction to Theory of Computation" Thomson Course Technology, Second Edition.

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3. Kavi Mahesh, "Theory of Computation" Wiley-India.

Course Outcomes:
After completing the course, students will be able to:

1. Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
2. An ability to design grammars and automata (recognizers) for different language classes.
3. An ability to identify formal language classes and prove language membership properties.
4. An ability to prove and disprove theorems establishing key properties of formal languages and automata.
5. Acquire a fundamental understanding of core concepts relating to the theory of computation and computational models including (but not limited to) decidability and intractability.