THEORY OF COMPUTATION

II B. Tech. - II Semester	L	T	P	C
Course Code: A3CS10	4	1	-	4

COURSE OVERVIEW:

Formal languages and automata theory deals with the concepts of automata, formal languages, grammar, computability and decidability. The reasons to study Formal Languages and Automata Theory are Automata Theory provides a simple, elegant view of the complex machine that we call a computer. Automata Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems. Further, parts of the Automata theory have direct bearing on practice, such as Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design; and Complexity on cryptography and optimization problems in manufacturing, business, and management. Last, but not least, research oriented students will make good use of the Automata theory studied in this course.

COURSE OBJECTIVES:

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing
3. To explain the hierarchy of problems arising in the computer sciences.
4. To familiarize Regular grammars, context frees grammar.

Course Outcomes: At the end of the course students will be able to:

1. To use basic concepts of formal languages of finite automata techniques
2. To Design Finite Automata’s for different Regular Expressions and Languages
3. To Construct context free grammar for various languages
4. To solve various problems of applying normal form techniques, push down automata and Turing Machines
5. To participate in GATE, PGECET and other competitive examinations

SYLLABUS

UNIT - I

FINITE AUTOMATA (FA): Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

UNIT - II

REGULAR EXPRESSIONS (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA’s to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions.

REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.

UNIT - III

CONTEXT FREE GRAMMER (CFG): Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG’s, Minimization of CFG’s, CNF, GNF, Pumping Lemma for CFL’s, Enumeration of Properties of CFL (Proof’s omitted).

UNIT – IV

PUSHDOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA.

TURING MACHINES (TM): Formal definition and behaviour, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.

UNIT V

RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), undecidability of PCP.

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages andComputation, 3rdedition, Pearson Education, India.

REFERENCE BOOKS:

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.