CSE322:FORMAL LANGUAGES AND AUTOMATION THEORY

L:3 T:0 P:0 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: analyze the fundamentals of theory of computation and design an infinite language in finite ways through deterministic finite automata, non deterministic finite automata

CO2 :: apply an infinite language in finite ways through regular expressions and understanding the properties of regular languages

CO3 :: illustrate context free grammar and pushdown automata for a given Language

CO4 :: formulate different abstract models like DFA, NDFA, PDA, CFGs and Turing machines for various computational problems

CO5 :: discuss properties of pushdown automata, context free language and abstract model of computing machine through turing machine

CO6 :: define whether a problem is decidable or undecidable

Unit I

FINITE AUTOMATA : The Equivalence of Deterministic and Non-deterministic Finite Automata, Definition and Description of a Finite Automaton, Deterministic and Non-deterministic Finite State Machines, Acceptability of a String by a Finite Automaton, Mealy and Moore Machines, Minimization of Finite Automata, Basics of Strings and Alphabets, Transition Graph and Properties of Transition Functions, Regular Languages

Unit II

REGULAR EXPRESSIONS AND REGULAR SETS : Regular Expressions and Identities for Regular Expressions, Finite Automata and Regular Expressions: Transition System Containing null moves, NDFA with null moves and Regular Expressions, Conversion of Non-deterministic Systems to Deterministic Systems, Algebraic Methods using Arden's Theorem, Construction of Finite Automata Equivalent to a Regular Expression, Equivalence of Two Finite Automata and Two Regular Expressions, Closure Properties of Regular Sets, Pumping Lemma for Regular Sets and its Application, Equivalence between regular languages: Construction of Finite Automata Equivalent to a Regular Expression, Properties of Regular Languages, Non-deterministic Finite Automata with Null Moves and Regular Expressions, Myhill-Nerode Theorem

Unit III

FORMAL LANGUAGES AND REGULAR GRAMMARS : Definition of a Grammar, Languages Generated by a Grammar, Chomsky Classification of Languages, Recursive and Recursively Enumerable Sets, Languages and Automata, Chomsky hierarchy of Languages, REGULAR GRAMMARS: Regular Sets and Regular Grammars, Converting Regular Expressions to Regular Grammars, Converting Regular Grammars to Regular Expressions, Left Linear and Right Linear Regular Grammars

Unit IV

CONTEXT- FREE LANGUAGES AND SIMPLIFICATION OF CONTEXT-FREE GRAMMAR : Ambiguity in Context Free Grammar, Language of a Context Free Grammar, Applications of Context Free Grammar, Pumping Lemma for Context Free Grammar, Normal Forms for Context Free Grammar -Chomsky Normal Form, Greibach Normal Form, Context-Free Languages and Derivation Trees, Leftmost and Rightmost derivations, Sentential forms, Construction of Reduced Grammars, Elimination of null and unit productions

Unit V

PUSHDOWN AUTOMATA AND PARSING : Representation of Pushdown Automata, Acceptance by Pushdown Automata, Pushdown Automata: Deterministic Pushdown Automata and non-deterministic Pushdown Automata, Context free languages and Pushdown Automata, PARSING: Top-Down and Bottom-Up Parsing, Description and Model of Pushdown Automata, Pushdown Automata and Context-Free Languages, Comparison of deterministic and non-deterministic versions, closure properties, LL (k) Grammars and its Properties, LR(k) Grammars and its Properties

Unit VI

TURING MACHINES AND COMPLEXITY : Turing Machine Model, Representation of Turing Machines, Design of Turing Machines, The Model of Linear Bounded Automaton, Power of LBA, Variations of TM, Non-Deterministic Turing Machines, Halting Problem of Turing Machine, Post Correspondence Problem, Basic Concepts of Computability, Decidable and Undecidable languages, RECURSIVELY ENUMERABLE LANGUAGE, Computational Complexity: Measuring Time & Space Complexity, Power of Linear Bounded Automaton, Variations of Turing Machine, Cellular automaton

Text Books:

1. THEORY OF COMPUTER SCIENCE: AUTOMATA, LANGUAGES & COMPUTATION by K.L.P. MISHRA & N. CHANDRASEKARAN, PRENTICE HALL

References:

1. AUTOMATA, COMPUTABILITY AND COMPLEXITY: THEORY AND APPLICATIONS by ELAINE RICH, PEARSON

References:

2. INTRODUCTION TO AUTOMATA THEORY, LANGUAGES, AND COMPUTATION by HOPCROFT, MOTWANI, ULLMAN, PEARSON

3. INTRODUCTION TO THE THEORY OF COMPUTATION by MICHAEL SIPSER, CENGAGE LEARNING

4. THEORY OF COMPUTATION: A PROBLEM SOLVING APPROACH by KAVI MAHESH, WILEY

5. INTRODUCTION TO FORMAL LANGUAGES, AUTOMATA THEORY AND COMPUTATION by KAMALA KRITHIVASAN, RAMA R., PEARSON

6. THEORY OF COMPUTATION by RAJESH K. SHUKLA, CENGAGE LEARNING

7. AN INTRODUCTION TO AUTOMATA THEORY AND FORMAL LANGUAGES. by ADESH K. PANDEY, S.K. KATARIA & SONS

8. INTRODUCTION TO THEORY OF AUTOMATA, FORMAL LANGUAGES AND COMPUTATION by SATINDER SINGH CHAHAL, GULJEET KAUR CHAHAL, A.B.S.PUBLICATION, JALANDHAR

9. AN INTRODUCTIONTO FORMAL LANGUAGES AND AUTOMATA by PETER LINZ, JONES & BARTLETT LEARNING

10. CELLULAR AUTOMATA MACHINES: A NEW ENVIRONMENT FOR MODELING by TOMMASO TOFFOLI, MIT Press