FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to CSE & IT)

Course Code: 15CT1119

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Pre-requisites:

None

Course Outcomes :

At the end of the Course, the Student will be able to:

CO 1 Design Finite Automata

CO 2 Convert Regular Expressions into Finite Automata& vice versa

CO 3 Interpret languages in the form of grammar

CO 4 Design Push down Automata

CO 5 Design Turing Machines

UNIT-I **(10 Lectures)**

FUNDAMENTALS & FINITE AUTOMATA:

Basic concepts, Formal languages, Strings, Alphabets, Languages, Finite state machine, definitions, Finite automaton model, Acceptance of strings and languages, Deterministic finite automaton (DFA) and Non-deterministic finite automaton (NFA), Equivalence of NFA and DFA, NFA to DFA conversion (Proof needed), NFA with ε -transitions, Significance, Conversion of NFA with ε -transitions to NFA without ε -transitions, Minimization of finite automata, Equivalence between two DFA's, Finite automata with output – Moore and Mealy machines, Equivalence between Moore and Mealy machines, conversion of Moore to Mealy and Mealy to Moore.

UNIT-II (10 Lectures)

REGULAR LANGUAGES:

Regular sets, Regular expressions, Operations and applications of regular expressions, Identity rules, Conversion of a given regular expression into a finite automaton, Conversion of finite automata into a regular expression (Arden's theorem Proof), Pumping lemma for regular sets (Proof needed), Closure properties of regular sets (proofs not required).

UNIT-III (10 Lectures)

REGULAR GRAMMARS & CONTEXT FREE GRAMMARS:

Definition of a grammar, Regular grammars, Right linear and left linear grammars, Conversion from left linear to right linear grammars, Equivalence of regular grammar and finite automata, Inter conversion, Context free grammars and languages, Derivation trees, Leftmost and rightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring in context free grammars, Minimization of context free grammars, Normal forms for context free grammars, Chomsky normal form, Greibach normal form, Closure and decision properties of context free languages

UNIT-IV (10 Lectures)

PUSHDOWN AUTOMATA:

Pushdown automata, definition, model, Graphical notation, Instantaneous descriptions, Acceptance of context free languages, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of context free grammars and pushdown automata, Inter-conversion(Proofs not required), Introduction to deterministic pushdown automata.

UNIT-V (10 Lectures)

TURING MACHINE:

Turing Machine, definition, model, Instantaneous descriptions, Representation of Turing machines, Design of Turing machines, Types of Turing machines, Computable functions, Recursive and

recursively enumerable languages and Church's hypothesis. (Proofs required)

TEXT BOOK:

Hopcroft H.E. and Ullman J. D, "Introduction to Automata Theory Languages and Computation", 3rd Edition, Pearson Education, 2011.

REFERENCES:

1. Mishra and Chandrashekaran, "Theory of Computer Science – Automata Languages and Computation", 3rd Edition, PHI, 2009
2. K.V.N.Sunitha , N.Kalyani, "Formal Languages and Automata Theory", 1st Edition, TMH, 2010
3. Michel Sipser, "Introduction to Theory of Computation", 2nd Edition, Thomson, 2012.

WEB REFERENCE:

http://nptel.iitm.ac.in/courses/webcourse-contents/IIT-%20Guwahati/afl/index.htm