

## MCA 302 Theory of Computation

### Module 1 (10 Hours)

Alphabet, languages and grammars. Production rules and derivation of languages. Chomsky's hierarchy of languages and Grammars. Regular grammars, regular expressions and finite automata (deterministic and nondeterministic). Closure and decision properties of regular sets. Pumping lemma of regular sets. Minimization of finite automata. Left and right linear grammars. DFA/NFA to regular expression and vice versa using Arden's Formula.

### Module 2 (10 Hours)

Context free grammars and pushdown automata. Chomsky and Greibach normal forms. Parse trees, Cook, Younger, Kasami, and Earley's parsing algorithms. Ambiguity and properties of context free languages. Pumping lemma, Ogden's lemma, Parikh's theorem. Deterministic pushdown automata, closure properties of deterministic context free languages.

### Module 3 (10 Hours)

Turing machines and variation of Turing machine model, Turing computability, Type 0 languages. Linear bounded automata and context sensitive languages. Primitive recursive functions. Cantor and Gödel numbering. Ackermann's function,  $\mu$ -recursive functions, recursiveness of Ackermann and Turing computable functions.

### Module 4 (10 Hours)

Church Turing hypothesis. Recursive and recursively enumerable sets. Universal Turing machine and undecidable problems. Undecidability of Post correspondence problem. Valid and invalid computations of Turing machines and some undecidable properties of context free language problems. Time complexity class P, class NP, NP completeness.

### Module 5 (6 Hours)

(as per choice of faculty)

Portion covered can be tested through Internal evaluation only not to be included in University examination)

### Text Books:

1. Introduction to Automata Theory, Languages and Computation: J.E. Hopcroft and J.DULLman, Pearson Education, 3rd Edition.
2. Introduction to the theory of computation: Michael Sipser, Cengage Learning

### Reference Books:

1. Automata Theory: Nasir and Srimani, Cambridge University Press.
2. Introduction to Computer Theory: Daniel I.A. Cohen, Willey India, 2nd Edition.