## MCPC1009 THEORY OF COMPUTATION (3-0-0)

Objectives:

1. Apply theory of computation concepts to solve problems in computer science
2. Understand the fundamental concepts of automata theory, formal languages, and computation models
3. Analyze and design finite automata
4. Understand the basics of Theory of Computation, design and minimize finite automata
5. Study the properties of regular languages, context-free languages
6. Analyze and design pushdown automata, understand context-free grammars
7. Understand Turing machines, analyze undecidable problems and recursively enumerable languages
8. Analyze complexity, understand formal language properties

Course Outcomes(CO):

Upon successful completion of this course, the student shall be able to:

CO1: Apply finite automata concepts to solve problems and describe the types of grammar and derivation tree

CO2: Analyze a given Finite Automata machine and find out its Language and apply pushdown automata and context-free grammar concepts to solve problems

CO3: Apply Turing machine concepts to solve problems

CO4: Apply complexity theory and formal language property concepts to solve problems

CO5: Develop a computational model using Turing machine for the given problem. · Examine the complexity for P and NP completeness for the given problem.

**Module-I**

Introduction to Theory of Computation, Finite Automata (FA): Deterministic FA (DFA) and Nondeterministic FA (NFA), Finite Automata with Epsilon-Transition.

**Module-II**

Regular expressions, Finite automata and Regular expressions, Applications of regular expressions, Algebraic laws of regular expressions, Pumping Lemma and its application for regular languages, Closure and Decision properties of regular languages.

**Module-III**

Context-Free Grammars, Parse trees, Ambiguity in Grammar & Languages, Pushdown automation. The language of PDA. Equivalence of PDA's and CFG's. Deterministic pushdown automata, Chomsky Normal form, the pumping Lemma for context free languages, Decision properties of CFL's.

**Module-IV**

The Turing machine, Programming techniques for Turing machines, Extension to the basic Turing machine, Restricted Turing machine, Turing machines and computers.

Non-Recursively enumerable languages, Undecidable problem that in recursively enumerable, Undecidable problem about Turing machines, Post's correspondence problem, other undecidable problems.

**Books:**

1. Introduction to Automata Theory, Languages and Computation- J.Hoperoft, R.Motwani ,J.D.Ullman– Pearson Education

**Reference Books:**

1. Introduction to Theory of Computation– M.Siper, Thomson Learning
2. P.Linz,“ An Introduction to formal Languages and Automata”,Norasa,2000
3. Lewish Papadimitra: Theory of Computations, Prentice Hall of India, New Delhi.