RAMAKRISHNA MISSION VIDYAMANDIRA

NEP Syllabus B.Sc. Computer Science Honours

Semester-V

Course Code: 5CMSMJC4

Course Type: Major Course

Course Outcome:

- Recall operations on set and define key terms like automata, formal languages, alphabets, strings and list types of automata like DFA, NFA, PDA, Turing Machine.
- Explain the differences between deterministic and non-deterministic automata, describe the significance of regular expressions in language recognition, and interpret the pumping lemma and its role in proving language properties.
- Construct finite automata from given regular expressions, design context-free grammars for simple languages and simulate Turing machines for basic computational problems.
- Analyze the closure properties of regular and context-free languages, compare and contrast the computational power of different automata models .
- Evaluate the applicability of automata models in real-world scenarios and assess the efficiency of different parsing techniques.
- Design a compiler component using finite automata for lexical analysis and develop a new automaton model to address a specific computational problem.

5CMSMJC4: Formal Language and Automata Theory

Credit: 3 **Marks: 50**

Finite Automata: Definition of a Finite Automaton, Model, Representation, Classification – with respect to output function Mealy and Moore Machines, conversion algorithms Mealy to Moore and Moore to Mealy, with respect to State Transition – Finite Automaton, Deterministic and Non-Deterministic Finite automaton, ϵ-transition, Non-Deterministic to equivalent Deterministic Automaton-Optimized and Non-optimized technique ideas and algorithms, Acceptability of String by a Finite Automaton. **[14 L]**

Regular Expression: Basic Idea and Definition, Regular Expression basic Identities, Arden's Theorem – Statement and Proof and application for reduction of equivalent regular expressions, Regular expression to Finite Automata conversion, State Transition System to Regular Expression conversion algorithm by Arden's Algebraic Method, closure properties of regular languages, Pumping Lemma. **[8 L]**

Formal Languages and Grammar: Introduction to Formal Grammar and Language, Chomsky's Classification of Grammar – Type-0, Type-1, Type-2 and Type-3 Grammar, Illustration of each of these

classes with example, Sentential form, Sentences – Languages or strings, Derivations. Context Free Grammar, Parsing, Normal forms: CNF and GNF, Pumping Lemma. **[10 L]**

PDA: Definition and basic idea about Push Down Automaton, Definition and basic idea about Linear Bounded Automata. **[4 L]**

Turing Machine: Concepts of Turing Machine, Formal Definitions, Classifications – Deterministic and Non-Deterministic Turing Machines, Simple Design of Turing Machines, Definition and significance of Halting Problem in Turing Machine, concepts of Multi-tape Turing Machine and Universal Turing Machine. **[9 L]**

5CMSMJC4 Tutorial : Formal Language and Automata Theory

Credit: 1 **Marks: 25**

Some real-life problems incorporating the application power and knowledge on construction of DFA, NFA, conversion of NFA to DFA, Language to Regular expression, CFG, PDA, CNF and GNF and Turing Machine.

Books and references:-

1. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson.
2. Introduction to Theory of Computation by Micheal Sipser, Cengage Learning.
3. Theory of Computer Science (Automata, Languages & Computation) by K. L. P. Mishra & N. Chandrasekaran, PHI
4. An Introduction to Formal Languages and Automata by Peter Linz, Narosa.