7th Sem Bsc IT (Honors)

SYLLABUS FORTHEORYOFCOMPUTATION

Credits: 4+2

Unit I:FoundationsandRegularLanguages

Introduction to computation, complexity, and computability. Review of sets, alphabets, strings, and languages. **Finite Automata (FA):** Deterministic Finite Automata (DFA), state tables & diagrams, Acceptability of a String by a Finite Automaton. **Nondeterministic Finite Automata (NFA):** Definition, equivalence of NFA and DFA, conversion from NFAtoDFA.**Minimizationof Finite Automata. RegularExpressions(RE):**Formaldefinition,identities,andtheequivalence of RE and Finite Automata. Conversion of FA to RE and vice versa. **Properties of Regular Languages:** Pumping Lemma for regular sets, closure properties. **Automata with Output (Transducers):** Mealy and Moore machines, and the conversion between them.

Unit II:Context-FreeLanguages

Formal Grammars: Introductiontogrammars,ChomskyClassificationoflanguages(overview). **Context-FreeGrammars(CFG):**Right-linearandleft-lineargrammars,derivationtrees,parsing (top-down, bottom-up), and ambiguity. **Simplification of CFGs. Normal Forms:** Chomsky Normal Form (CNF) and Greibach Normal Form (GNF). **Properties of Context-Free Languages (CFLs).**

Unit III:PushdownDownAutomata

Pushdown Automata (PDA): Introduction to PDAs, deterministic and non-deterministic PDAs. **Relationship between PDA and CFL:** Equivalence of PDAs and CFGs, conversion fromPDA to CFG. Concepts in parsing. Introduction to context sensitive grammars.

UnitI V: TuringMachinesandRecursiveEnumerableLanguages

Chomsky Hierarchy: A detailed lookatRegularGrammars,Context-SensitiveLanguages,and their corresponding automata. **Recursive and Recursively Enumerable Languages:** Definitions and properties.**The Turing Machine (TM):** Formal definition and model, computing with Turing Machines. **Types and Variants of TMs:** Multi-tape TM, Multi-dimensional TM,Multi-head TM, and Nondeterministic Turing Machines. **The Church-Turing Thesis:** The definition of an algorithm **Universal Turing Machines. Decidability and Undecidability:** Unrestricted grammars, the concept of decidable vs. undecidable problems. **Reducibility:** A technique for proving problems are undecidable. **The Halting Problem:** Proving its undecidability. **The Post Correspondence Problem (PCP).**

References:

1. *Introduction to Automata Theory, Languages, and Computation* by Hopcroft, Motwani, Ullman.

2. *An Introduction to Formal Languages and Automata* by Peter Linz".

3. *Introduction to the Theory of Computation* by Michael Sipser.