BCSC0011: THEORY OF AUTOMATA & FORMAL LANGUAGES

Objective: *The objective of this course is that students will study and compare different models and views of the abstract notion of computation and its various aspects.*

Credits:04 **Semester V** **L-T-P:3-1-0**

Module No.	Content	Teaching Hours
I	**Introduction:** Alphabets, Strings and Languages; Automata and Grammars, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Equivalence of NFA and DFA, Minimization of Finite Automata, Myhill-Nerode Theorem; FA with Output - Moore and Mealy machine, Applications and Limitations of FA. **Regular expression (RE):** Regular Expression to FA, DFA to Regular Expression, Arden Theorem, Non Regular Languages, Pumping Lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages. **Push Down Automata (PDA):** Introduction, Language of PDA, Acceptance by Final State, Acceptance by Empty Stack, Deterministic PDA.	20
II	**Context Free Grammar (CFG) and Context Free Languages (CFL):** Introduction, Derivation Trees, Ambiguity in Grammar, Ambiguous to Unambiguous CFG, Simplification of CFGs, Normal Forms for CFGs - CNF and GNF; Pumping lemma for CFLs, Equivalence of PDA and CFG. **Turing machines (TM):** Basic Model, Definition and Representation, Variants of Turing Machine and their equivalence, TM for Computing Integer Functions, Universal TM, Church's Thesis, Recursive and Recursively Enumerable Languages, Halting Problem, Introduction to Computational Complexity.	20

Text Books:

- K.L.P. Mishra and N.Chandrasekaran (2006), "Theory of Computer Science: Automata, Languages and Computation", 3rd Edition, PHI.

Reference Books:

- Hopcroft, Ullman (2013), "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education.
- Martin J. C (2011), "Introduction to Languages and Theory of Computations", 4th Edition, TMH.

Outcome: After completion of course, the student will be able to:

- Construct FA and minimize automata;
- Construct an automaton for a given regular expression;
- Construct a pushdown automaton for a given context-free language;
- Construct a Turing machine deciding a given problem,
- Prove whether a language is or is not a regular or context-free by using the Pumping Lemma;
- Prove that a given context-free grammar generates a given context-free language;
- Prove un-decidability of a given problem by reducing from a known un-decidable problem