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***CS4402 Formal Languages & Automata Theory***

**L-T-P-Cr: 3-1-0-4**

**Pre-requisites:** None

**Objectives/Overview:**

* To provide theoretical concept of computation.
* To provide knowledge on application of automata in computer science

**Course Outcomes:**

At the end of the course, a student should come to know:

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| **Sl. No** | **Outcome** | **Mapping to PO** |
| 1 | Basic concepts of several formal languages, their machine portions and their relationship | PO1 |
|  | Basic concepts and need of Regular expression, Non-deterministic and deterministic finite automata | PO1, PO2 |
|  | Design of Non-deterministic and deterministic finite automata | PO2, PO3 |
|  | Concepts, need and construction of Context Free Grammar, Context Sensitive Grammar and Regular grammar | PO1, PO2,PO3 |
|  | Design of push down automata | PO1, PO2,PO3 |
|  | Design and need of Turing machines | PO1, PO2, PO3 |

**UNIT I: Introduction Lectures: 10**

**Introduction to Automata:** Study and Central concepts of automata theory, An informal picture of finite automata, deterministic and non-deterministic finite automata, application of finite automata, finite automata with epsilon transitions; **Regular Expression and Languages:** Regular expression, finite automata and regular expressions, applications of regular expressions, algebraic laws of regular expressions.

**UNIT II:** **Regular Language and Context-free Languages Lectures: 10**

**Properties of Regular Language:** Proving languages not to be regular, closure properties of regular languages, equivalence and minimization of automata; **Context-free Grammars and Languages:** Parse trees, Applications of context free grammars, Ambiguity in grammars and languages.

**UNIT III: Pushdown Automata Lectures: 10**

**Pushdown Automata:** Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, deterministic pushdown automata; **Properties of Context-Free Languages:** Normal forms of context free grammars, pumping lemma for context free languages, closure properties of context free languages.

**UNIT IV: Turing Machine Lectures: 12**

**Introduction to Turing Machine:** The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, restricted Turing Machines, Turing machines and Computers, Undecidable Problem about Turing Machine, Post’s Correspondence Problem; **Intractable Problem:** The Classes *P* & *NP,* NP-Complete Problem, Example of *P& NP* Problem.

**Text Book:**

1. *Introduction to Automata Theory, Languages, and Computation, 2e*, by John E. Hopcroft, Rajeev Motwani, and Jeffery D. Ullman, Pearson Education.