**19CST08: THEORY OF COMPUTATION**

**Credits – 3 Sessional Marks: 30**

**L:T:P :: 2:1:0 University Exam Marks: 70**

**Course Objectives**

To expose the students to the following:

* + - 1. Build the skills for designing finite automata to accept a set of strings of a language.

1. Develop knowledge about the formal notation for strings, languages and machines.
2. Learn basic concepts related to regular expressions and Turing machine and its related concepts.
3. Design context free grammars to generate strings from a context free language and convert them into normal forms.
4. Enhance their knowledge to about pushdown automata and enable them to convert CFG to PDA.

**Course Outcomes**

After successful completion of course the student should be able to

1. Understand a formal notation for strings, languages and machines, the hierarchy of formal languages, grammars and machines.
2. Design finite automata to accept a set of strings of a language, context free grammars to generate strings of context free language.
3. Apply concepts of context free grammars to resolve the real-time problems.
4. Determine whether the given language is regular or not, equivalence of languages accepted by Push-Down Automata and languages generated by context free grammars.
5. Analyse languages of Turing machine.

**UNIT I**

**Finite Automata:**Alphabets, Strings, Grammar and Languages, Chomsky Hierarchy, Finite Automata, Representation of FA, Types of Finite Automata, Conversion of NFA into DFA, Equivalence of DFA and NFA, Finite Automata with Epsilon transitions (є-NFA or NFA- є), Finite Automata with output, Conversion of one machine to another, Minimization of Finite Automata, Myhill-Nerode Theorem, Applications and Limitation of Finite Automata.

**UNIT II**

**Regular Expressions:** Regular Expressions (RE), Identity Rules, The Arden’s Theorem, Applications of Pumping Lemma, Equivalence of Two FAs, Equivalence of Two REs, Construction of Regular Grammar from RE, Constructing FA from Regular Grammar, Closure properties of RLs, Pumping Lemma for RLs, Decision problems of RLS, Applications of REs and FAs.

**UNIT III**

**Context Free Grammars:** Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars, Left recursion and Left factoring, Linear Grammar, Conversion Methods of Linear Grammar, Normal Forms for Context Free Grammars, Pumping Lemma for CFLs, Closure Properties, Applications of Context Free Grammars.

**UNIT IV**

**Pushdown Automata:** Pushdown Automata, Instantaneous Description, Language Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Conversion of CFG to PDA and PDA to CFG, Equivalence of Pushdown Automata, Two Stack Pushdown Automata.

**UNIT V**

**Turing Machine:** Turing Machine, Instantaneous Descriptions, Representation of TMs, Language Acceptance of a Turing Machine, Design of Turing Machines, Variations of Turing Machines, Church’s Thesis, Universal Turing Machine, Linear Bounded Automata, TM Languages, Unrestricted grammar, Properties of Recursive and Recursively enumerable languages, Un-decidability, Reducibility, Un-decidable problems about TMs, Post Correspondence Problem (PCP), Modified PCP.

**Text Books**

1. ShyamalenduKandar, “Introduction to Automata Theory, Formal Languages and Computation”, Pearson education, 2013.
2. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, “Introduction to Automata Theory, Languages, and Computation”, Pearson Education Asia, 2012.

**Reference Books**

1. Peter Linz, “An Introduction to formal languages and automata”, 6th Edition, Jones & Bartlett, 2012.
2. Rajendra Kumar “Theory of Automata, Languages and Computation”, McGraw Hill, 2014.
3. Krithivasan Kamala, Rama R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education, 2009.

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO1** | **H** | **M** |  |  |  |  |  |  |  |  |  |  | **H** |  |  |  |
| **CO2** |  | **M** | **H** |  |  |  |  |  |  |  |  |  |  |  | **M** |  |
| **CO3** |  | **L** | **H** |  |  |  |  | **M** |  |  |  |  | **H** |  | **M** |  |
| **CO4** |  | **L** |  | **H** |  |  |  |  |  |  |  |  |  |  | **H** |  |
| **CO5** |  | **H** |  |  |  |  |  |  |  |  |  |  | **H** |  |  |  |

**Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping**