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| **Subject Code**  **20CST-353** | **Theory of Computation** | **L** | **T** | **P** | **S** | **C** |
| **Total Contact Hours : 45 Hours** | **3** | **0** | **0** | **0** | **3** |
|  | | | | | |
| **Pre-requisites** | Knowing importance of system programs | | | | | |
| **Co-requisites** | **--** | | | | | |
| **Anti-Requisites** | **--** | | | | | |

**Course Objectives:**

* To understand the concept of formal languages and their relation with finite automata.
* To study and design different finite automata.
* To study context free grammars and ambiguity related issues.
* To gain familiarization with Push- Down Automata and Turing Machines.
* To explore relationship between different classes of formal languages.

**Course Outcomes:**

* Gain knowledge of formal languages and classify basic operations on them.
* Illustrate Finite Automata and differentiate DFA and NFA with the help of examples
* Explain and support the properties of Regular sets using pumping lemma and theorems.
* Apply the knowledge of Context Free Grammar to estimate all possible patterns of strings in a given formal language.
* Implementation of Chomsky hierarchy using the concept of Turing Machine, Pushdown Automata.

**Contents of the Syllabus**

# UNIT –I

**Introduction:** Basic Terminology: Alphabet, Formal Language and operations on formal languages, Examples of formal languages.

**Finite automata:** Concept of Basic Machines, Properties and Limitations of Finite State Machines, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Equivalence of DFA and NDFA, Non-Deterministic Finite automata with Λ-Transitions.

**Regular expression**: Regular Languages and Regular Expressions, Kleen’s Theorem. Arden’s Method.

# UNIT –II

**Properties of Regular sets:** The Pumping Lemma for Regular sets, Application of the Pumping Lemma, Closure Properties of Regular Sets, Myhill- Nerode Theorem and Minimization of Finite Automata, Minimization Algorithm.

**Finite Automata with output:** Moore and Mealy Machines. Equivalence of Moore and Mealy Machines.

**Context Free Grammars:** Examples and Definitions, Derivation trees and ambiguity, An Unambiguous CFG for Algebraic Expressions. Regular Grammar, Simplified forms and Normal forms: Removal of useless symbols and unit production, Removal of Λ-moves, Chomsky Normal Form (CNF), Griebach Normal Form (GNF).

# UNIT –III

**Context sensitive Language**: Context sensitive Language and grammar, Relation between languages of classes

**Pushdown Automata**: Introduction and Definition of Push-Down Automaton, Applications of Push Down Automata.

**Turing Machines**: Definitions and Examples, Deterministic and Non- Deterministic Turing Machines, Unsolvable Problems: A Non recursive Language and an Unsolvable Problem, PCP Problem and MPCP Problem.

**More General Languages and Grammars:** Recursively Enumerable and Recursive Languages, Unrestricted grammars, Chomsky hierarchies of grammars.

# Text Books:

1. Martin J.C., “Introduction *to Languages and Theory of Computation*”, Tata McGraw-Hill Publishing Company Limited, 3rd Edition.
2. Hopcroft J.E. and Ullman J.D., “Introduction *to Automata Theory Languages and Computation*”, Narosa Publications.

# Reference Books:

1. Sipser,” *Theory of Computation*, Cengage Learning.
2. Daniel I.A. Cohen, “*Introduction to computer Theory*”, John Wiley.

# Mode of Evaluation: The performance of students is evaluated as follows:

|  |  |  |
| --- | --- | --- |
|  | **Theory** | |
| **Components** | **Continuous Internal Assessment (CAE)** | **Semester End Examination (SEE)** |
| **Marks** | **40** | **60** |
| **Total Marks** | **100** | |

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| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | 1 | - | - | - | - | - | - | - | 1 | - |
| CO2 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | 1 | - |
| CO3 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | 1 | - |
| CO4 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | - |
| CO5 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | 2 | - |