FORMAL LANGUAGES AND AUTOMATA THEORY
[Revised Credit System]
(Effective from the academic year 2022-23)
SEMESTER - IV

Subject Code	**CSE 2127**	**IA Marks**	**50**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**50**
Total Number of Lecture Hours	**36**	**Exam Hours**	**03**

CREDITS - 03

Course objectives: This course will enable students to

- Understand the mathematical meaning of Grammar
- Know how to generate Languages using grammars
- Design Automata for various languages
- Understand theory of computation and computational models

Module -1	**Teaching Hours**
INTRODUCTION TO THE THEORY OF COMPUTATION AND FINITE AUTOMATA: Three basic concepts, Some Applications, Deterministic Finite Accepters, Nondeterministic Finite Accepters, Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata. **Text Book 1**: Chapter 1:1.2 - 1.3, Chapter 2: 2.1 - 2.4	**08 Hours**
Module -2	
REGULAR LANGUAGES, REGULAR GRAMMARS AND PROPERTIES OF REGULAR LANGUAGES: Regular Expressions, Connection between Regular Expressions and Regular Languages, Regular Grammars, Closure Properties of Regular Languages, Identifying Non-regular Languages. **Text Book 1:** Chapter 3: 3.1 -3.3, Chapter 4: 4.1,4.3	**07 Hours**
Module – 3	
CONTEXT-FREE LANGUAGES AND SIMPLIFICATION OF CONTEXT-FREE GRAMMARS AND NORMAL FORMS: Context-Free grammars, Parsing and Ambiguity, Methods for Transforming Grammars, Two important Normal Forms. **Text Book 1:** Chapter 5: 5.1 -5.2, Chapter 6: 6.1 – 6.2	**05 Hours**
Module-4	
PUSHDOWN AUTOMATA AND PROPERTIES OF CONTEXT-FREE LANGUAGES: Nondeterministic Pushdown Automata, Pushdown Automata and Context–Free Languages, Deterministic Pushdown Automata and Deterministic Context-Free Languages, A Pumping Lemma for Context Free Languages, Closure properties and Decision Algorithms for Context-Free Languages. **Text Book 1:** Chapter 7: 7.1 – 7.3, Chapter 8: 8.1,8.2	**06 Hours**

Module-5	
TURING MACHINES AND OTHER MODELS OF TURING MACHINES: The Standard Turing Machine, Nondeterministic Turing Machines, A Universal Turing Machine. **A HIERARCHY OF FORMAL LANGUAGES & AUTOMATA** Recursive and Recursively Enumerable Languages, Unrestricted grammars, Context-Sensitive Grammars and Languages, The Chomsky Hierarchy. **LIMITS OF ALGORITHMIC COMPUTATION** Some Problems That Cannot Be Solved by Turing Machines, The Post Correspondence Problem **Text Book 1:** Chapter 9: 9.1, Chapter 10:10.3-10.4, Chapter 11: 11.1-11.4 Chapter 12: 12.1, 12.3	**10 Hours**

Course outcomes:

After studying this course, students will be able to:

1. Acquire knowledge of fundamental concepts in grammars, languages and automata.
2. Ability to design grammars for regular and context-free languages.
3. Ability to construct languages from different grammars and simplification of grammars.
4. Ability to design automata for different language classes
5. Acquire a fundamental understanding of core concepts relating to the theory of computation and computational models

Text Books:

1. Peter Linz, *An Introduction to Formal Languages and Automat*, (6e), Jones & Bartlett Learning, 2019.

Reference Books:

1. J E Hopcroft, Rajeev Motwani & Jeffrey D Ullman, *Introduction to Automata Theory, Languages and Computation*, (3e), Pearson Education, 2006.
2. John C Martin, *Introduction to Languages and the Theory of Computation*, (3e), McGraw Hill, India, 2007.
3. Rajendra Kumar, *Theory of Automata, languages and computation*, Tata McGraw-Hill Education, 2010
4. K.L.P. Mishra, N.Chandrashekharan, *Theory of Computer Science*, (3e), PHI publications 2007