Subject Code : CSI1003	Formal Language Theory	L, T, P, J, C 3, 0, 0, 0, 3
Preamble	Course should provide a mathematical approach to computer science and to give an understanding of theoretical computer science, especially to the theory of formal languages and automata theory. Both of them are represented in a mathematical view towards computation approach for solving problems.	
Objectives	The objective of this course is to learn • Types of grammars and models of automata. • Limitation of computation: What can be and what cannot be computed. • Establishing connections among grammars, automata and formal languages.	
Expected Outcome	After successfully completing the course the student should be able to 1. Model, compare and analyse different computational models 2. Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata. 3. Identify limitations of some computational models and possible methods of proving them. 4. Explain the abstract concepts mathematically with notations	
SLOs	1,5,9	

Module	Topics	L Hours	SLO
1	**Introduction to Languages and Grammars:** Recall on Proof techniques in Mathematics -Overview of a Computational Models - Languages and Grammars - Alphabets - Strings - Operations on Languages, Overview on Automata	4	1
2	**Finite State Automata:** Finite Automata (FA) - Deterministic Finite Automata (DFA) - Non-deterministic Finite Automata (NFA) - NFA with epsilon transitions – NFA without epsilon transition, conversion of NFA to DFA, Equivalence of NFA and DFA – minimization of DFA Moors and Melay Machines.	8	5,9
3	**Regular Expressions and Languages:** Regular Expression - FA and Regular Expressions: FA to regular expression and regular expression to FA - Pattern matching and regular expressions - Regular grammar and FA- Pumping lemma for regular languages - Closure properties of regular languages, linear grammars and linear languages.	7	5,9
4	**Context Free Grammars:** Context-Free Grammar (CFG) – Derivations- Parse Trees - Ambiguity in CFG - CYK algorithm – Simplification of CFG – Elimination of Useless symbols, Unit productions, Null productions - Normal forms for CFG: CNF and GNF - Pumping Lemma for CFL - Closure Properties of CFL, context-sensitive grammars definition and examples	7	1,5
5	**Pushdown Automata:**		5,9

	Definition of the Pushdown automata - Languages of a Pushdown automata – Power of Non-Deterministic Pushdown Automata and deterministic pushdown automata	5	
6	**Turing Machine:** Turing Machines as acceptor and transducer - Multi head and Multi tape Turing Machines – Universal Turing Machine - The Halting problem - Turing-Church thesis	6	5,9
7	**Recursive and Recursively Enumerable Languages:** Recursive and Recursively Enumerable Languages, Language that is not Recursively Enumerable (RE) – computable functions – Chomsky Hierarchy – Undecidable problems - Post's Correspondence Problem	6	5
8	Recent Trends & Future of Formal Languages and Automata	2	1,5,9

Text Books (overall syllabus covered)

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2012.

2. Peter Linz, "An Introduction to Formal Language and Automata", Third Edition, Narosa Publishers, New Delhi, 2002.

Reference

1. K. Krithivasan and R. Rama, "Introduction to Formal Languages, Automata and Computation", Pearson Education, 2009.

2. Micheal Sipser, Introduction of the Theory and Computation, Thomson Brokecole, 1997.

3. Dexter C. Kozen, " Automata and Computability", Springer Publishers, 2007.

CO-PO MAPPING:

H: High (3), M: Medium (2), L: Low (1)

COs	PO_1	PO_2	PO_5	PO_6	PO7	PO9
CO1						
CO2						
CO3						
CO4						