Course: BTech **Semester:** 5

Prerequisite: Calculus, Data Structures, and Algorithms

Rationale: Formal Language & Automata Theory helps in natural language processing to solve a problem on a model of computation, using an algorithm. It enables to learn in which machine can be made to think.

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/Week	Tutorial Hrs/Week	Lab Hrs/Week	Hrs/Week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
3	0	0	0	3	20	20	-	60	-	100

SEE - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Introduction:** Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages	5	2
2	**Regular languages and finite automata:** Regular expressions and languages, deterministic finite automata -(DFA) and equivalence with regular expressions,Moore machines and mealy machines, Conversion from Mealy to Moore and vice versa, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.	30	12
3	**Grammars:** Context-free grammars (CFG) and languages (CFL), Chomsky normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. , Context-sensitive languages: Context-sensitive grammars (CSG) and languages.	35	15
4	**Turing machines:** The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing- decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.	25	10
5	**Undecidability:**Church Turing thesis, universal Turing machine, the universal and diagonalization languages	5	6

Reference Books

1.	**Introduction to Automata theory, languages and Computation (TextBook)** By John E. Hopcroft, Rajiv Motwani and Jeffery D. Ullman | Pearson
2.	**Elements of the Theory of Computation** By Harry R.Lewis and Christos H. Papadimitriou | Pearson Education Asia
3.	**Introduction to the Theory of Computation** By Michael Sipser | PWS Publishing
4.	**Introduction to Languages and the Theory of Computation** By John C. Martin | McGraw Hill
5.	**Automata and Computability** By Dexter C. Kozen | Undergraduate Texts in Computer Science, Springer