Name of the Programme: MCA
Course Code: CSA-531
Title of Course: Theory of Computation
Number of Credits: 4 (4L-0T-0P)
Effective from AY: 2022-23

Prerequisites for the course	Programme Prerequisites	
Objectives	1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages 2. To illustrate finite state machines to solve problems in computing.	
Content	General Concepts of Automata Theory: Alphabets Strings, Languages, Grammars, Applications of Automata Theory.	3 hours
	Finite Automata (FA): Introduction, Deterministic Finite Automata (DFA) - definition and notations, language of a DFA. Nondeterministic Finite Automata (NFA)- Definition, language of an NFA, Equivalence of DFA and NFA, Applications of FA. Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of DFA. Finite automata with output (Moore and Mealy machines) and inter-conversion.	12 hours
	Regular Expressions (RE): Introduction, Identities of RE. Finite Automata and Regular Expressions - conversions, Algebraic Laws for Regular Expressions, applications of RE. Regular grammars: Definition, regular grammars, and FA, Proving languages to be non-regular (Pumping lemma), Properties of Regular Language, applications.	10 hours
	Context-Free Grammar (CFG): Definition, Derivations Using a Grammar-Leftmost and rightmost derivation, Parse tree, Applications, Ambiguity in CFG. Minimization of CFG, CNF, GNF, Pumping Lemma for CFL's.	10 hours
	Pushdown Automata (PDA): Definition, Language of PDA- Acceptance by Final State and Acceptance by Empty stack, Equivalence of CFG and PDA, Deterministic PDA, Chmosky normal form of CFG Turing Machines (TM): Formal definition and behavior, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.	15 hours
	Recursive And Recursively Enumerable Languages (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context-sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability.	10 hours
Pedagogy	lectures/ tutorials/assignments/self-study	
References/ Readings	1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, Pearson Education, India (latest edition) 2. H.R.Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, PHI, (latest edition) 3. J.Martin, Introduction to Languages and the Theory of Computation, TMH (latest edition)	
Course Outcomes	At the end of the course students will be able to: ● use basic concepts of formal languages of finite automata techniques ● design Finite Automata for different Regular Expressions and Languages ● Construct context-free grammar for various languages	