Course Code: CSE1008	Course Title: Theory of Computation	TPC	4	0	4
Version No.	2.0				
Course Pre-requisites/ Co-requisites	None				
Anti-requisites (if any).	None				
Objectives:	1. To understand the essential mathematical foundations of automata theory. 2. To design, finite state automata and the equivalent regular expression for any given pattern. 3. To analyze and design Context Free Grammar, Pushdown Automata and Turing Machine. 4. To understand the difference between decidability and undesirability.				

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	POs/ PEOs/PSOs
CO1	Understand the abstract machines, computation and basic properties of formal languages, finite automata	PO1, PO3
CO2	Familiarity with regular language, regular expression, context-free grammars and can make grammars to produce strings from a specific language	PO1, PO2, PO3
CO3	Can differentiate regular, context-free and recursively enumerable languages and can compare and analyse to different computational models.	PO3, PO4, PO5
CO4	Acquire concepts relating to computational models including decidability and intractability and can identify limitations of some computational models and possible methods of proving them	PO3, PO4, PO5
		Total Hours of Instructions: 60

Module No. 1	Finite Automata (FA)	11 Hours

Mathematical preliminaries and notations-Finite Automata-Deterministic Finite Automata – Non-Deterministic Finite Automata and equivalence with DFA - Epsilon transitions – Minimization of Finite Automata and its applications.

Module No. 2	Regular Expressions (RE)	9 Hours

Definition, Operators of regular expression and their precedence- Algebraic laws for Regular expressions and Kleene's Theorem - Regular expression to FA- DFA to Regular expression- Pumping Lemma for regular Languages

Module No. 3	RE & Context Free Grammar (CFG)	9 Hours

Closure properties of Regular Languages- Decision properties of Regular Languages -Context-Free Grammar (CFG) – Derivation Trees – Ambiguity in Grammars and Languages

Module No. 4	Pushdown Automata (PDA)	11 Hours

Definition, Graphical Notation, Instantaneous Descriptions of PDA- Acceptance by Final state, Acceptance by empty stack, Deterministic PDA- CFG to PDA - PDA to CFG

Module No. 5	Normal forms of CFG	9 Hours

Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs

Module No. 6	Turing Machine	11 Hours
Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM- Undecidable problems about TMs-Post correspondence problem (PCP)-Modified PCP- Introduction to recursive function theory - Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines		

Text Books

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3rd Edition, 2013.

References

1. Micheal Sipser, "Introduction of the Theory and Computation", Cengage Learning, 3rd edition, 2014.
2. Martin J. C., "Introduction to Languages and Theory of Computations", McGraw Higher Ed, 3rd edition, 2009.
3. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI, Third edition, 2009.
4. Papadimitriou, C. and Lewis, C. L., "Elements of the Theory of Computation", Pearson, 2nd edition, 2015.

Course Type	**Theory Only(TH)**	
Mode of Evaluation	**Theory**	**100%**
	Continuous Assessment Test-1	15%
	Continuous Assessment Test-2	15%
	Digital Assignments/Quizes(Min)	30%
	Final Assessment Test	40%
Modified by	**Dr. Saroj Kumar P**	
Recommended by the Board of Studies on	**12th BoS 29-04-2023**	
Date of Approval by the Academic Council	**10th Academic Council, 01.06.2023**	

Justification: As per the New Curriculum for B. Tech 2021-22 A.Y., the core courses should be of 4 credits. Hence, the credit structure of this course is also changed to 4-0-4. Though the contents remain the same more time will be spent on numerical problem solving.