Course Code	21CSC301T	Course Name	FORMAL LANGUAGE AND AUTOMATA	Course Category	C	PROFESSIONAL CORE	L	T	P	C
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Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*School of Computing*	Data Book / Codes / Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*construct automata for any equivalent regular expressions*
CLR-2:	*acquire brief knowledge about automata languages*
CLR-3:	*analyze about context free grammars and its implementation in Push down automata*
CLR-4:	*interpret the power of Turing machine and the decidable nature of a problem*
CLR-5:	*categorize undecidable problems and NP class problems*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	*summarize the basic concepts of deterministic and non-deterministic finite automata and its applications*	-	*1*	*1*	-	-	-	-	-	-	-	-	-	*1*	*3*	-
CO-2:	*analyze the formal relationships among machines, languages and Context free grammars and its normalization*	-	*3*	*3*	-	-	-	-	-	-	-	-	-	*1*	*3*	-
CO-3:	*construct the Push down stack machine and its context free language acceptance and its equivalence with CFG*	-	*2*	*2*	-	-	-	-	-	-	-	-	-	*1*	*3*	-
CO-4:	*analyze the techniques for Turing machine construction and its recursive languages and functions*	-	*2*	*2*	-	-	-	-	-	-	-	-	-	*1*	*3*	-
CO-5:	*evaluate the computational complexity of various problems*	-	*3*	*3*	-	-	-	-	-	-	-	-	-	*1*	*3*	-

Unit-1 – Finite Automata and Regular Expressions	***9 Hour***
Deterministic and Non-Deterministic Finite Automata, Finite Automata with ε-moves, regular expressions – equivalence of NFA and DFA, two-way finite automata, Moore and Mealy machines, Equivalence of Moore and Mealy machines, applications of finite automata.	
Unit-2 – Regular Sets and Context Free Grammars	***9 Hour***
Properties of regular sets, context-Free Grammars, and Languages – derivation trees, Simplification of CFG: Elimination of Useless Symbols Simplification of CFG: Unit productions, Null productions – Chomsky Normal Forms and Greibach Normal Forms, ambiguous and unambiguous grammars; minimization of finite automata	
Unit-3 – Pushdown Automata and Parsing Algorithms	***9 Hour***
Deterministic Push Down Automata – Non-Deterministic Push Down Automata – Equivalence of Pushdown Automata and context-free languages; Properties of CFL; Applications of pumping lemma — closure properties of CFL and decision algorithms; Overview of Top-down parsing and Bottom-up parsing	
Unit-4 – Turing machines	***9 Hour***
Turing machines ™ – computable languages and functions – tuning machine constructions – storage in finite control – variations of TMs – Church-Turing thesis – Universal Turing machine– recursive and recursively enumerable languages	
Unit-5 – Introduction to Computational Complexity	***9 Hour***
Time and Space complexity of TMs – complexity classes – introduction to NP-Hardness and NP-Completeness Post Correspondence Problems (PCP) – Modified PCP – Halting Problems – Undecidability Problems	

Learning Resources	1. *Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2008.* 2. *Michael Sipser, "Introduction to the Theory of Computation" Cengage Learning, 2012*	3. *John.C. Martin, "Introduction to Languages and the Theory of Computation" McGraw-Hill Education, 01- May-2010.* 4. *Peter Linz, "An introduction to formal languages and automata", Jones & Bartlett Learning, Sixth Edition, 2017*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Expert Member from TCS		
1. Santhosh Muniswami, Cisco Systems, Inc.	*1. Dr. P. Victer Paul, Indian Institute of Information Technology Kottayam*	*1. Dr. N. Arunachalam*
2. B. Divya, TCS	*2. Dr.C. Punitha Devi, Pondicherry University,*	*2. Dr. K. Vijaya*