

SHORT SYLLABUS

BCSE304L Theory of Computation(3-0-0-3)

Concepts of Proof technique - Regular sets - Finite automata - Regular Expressions - Minimization of finite automata - Context-free languages - Normal Forms for grammars - Pushdown automata - Turing machines.

BCSE304L	Theory of Computation	L	T	P	C
		3	0	0	3
Pre-requisite	Nil	Syllabus version			
		1.0			
Course Objectives					
1. Types of grammars and models of automata.					
2. Limitation of computation: What can be and what cannot be computed.					
3. Establishing connections among grammars, automata and formal languages.					
Course Outcome					
On completion of this course, student should be able to:					
1. 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. Represent the abstract concepts mathematically with notations.					
Module:1	Introduction to Languages and Grammars	4 hours			
Recall on Proof techniques in Mathematics - Overview of a Computational Models - Languages and Grammars - Alphabets - Strings - Operations on Languages, Overview on Automata					
Module:2	Finite State Automata	8 hours			
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					
Module:3	Regular Expressions and Languages	7 hours			
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					
Module:4	Context Free Grammars	7 hours			
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					
Module:5	Pushdown Automata	5 hours			
Definition of the Pushdown automata - Languages of a Pushdown automata – Power of Non-Deterministic Pushdown Automata and Deterministic pushdown automata					
Module:6	Turing Machine	6 hours			
Turing Machines as acceptor and transducer - Multi head and Multi tape Turing Machines – Universal Turing Machine - The Halting problem - Turing-Church thesis					
Module:7	Recursive and Recursively Enumerable Languages	6 hours			
Recursive and Recursively Enumerable Languages, Language that is not Recursively Enumerable (RE) – computable functions – Chomsky Hierarchy – Undecidable problems - Post's Correspondence Problem					
Module:8	Contemporary Issues	2 hours			
		Total Lecture hours:		45 hours	
Text Book					
1.	J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, India 2008. ISBN: 978-8131720479				
Reference Books					

1.	Peter Linz, “An Introduction to Formal Languages and Automata”, Sixth Edition, Jones & Bartlett, 2016. ISBN: 978-9384323219		
2.	K. Krithivasan and R. Rama, “Introduction to Formal Languages, Automata and Computation”, Pearson Education, 2009. ISBN: 978-8131723562		
Mode of Evaluation: CAT, Assignment, Quiz, FAT.			
Recommended by Board of Studies		04-03-2022	
Approved by Academic Council		No. 65	Date 17-03-2022