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