Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai) Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PCC)	Theory of Computation	3	0	0	5	8	3	0	0	3
		Examination Scheme								
CE304		Component	ISE		MSE		ESE		Total	
		Theory	20		20		60		100	
		Laboratory	--		--		--		--	

Pre-requisite Course Codes, if any.	CE/CS201: Discrete Structures and Graph Theory
Course Objective: To give an overview of the theoretical foundations of computer science from the perspective of formal languages which provides the mathematical foundation of formal models of computation, and fundamentals of formal grammars and languages that are used in most areas of computer science.	
Course Outcomes (CO): ***At the end of the course students will be able to***	
CE/CS304.1	Design finite automata for regular expressions and languages.
CE/CS304.2	Understand and apply properties of regular languages.
CE/CS304.3	Design context-free grammar for a language and convert it into normal forms.
CE/CS304.4	Design Pushdown Automata and Turing Machine for a language.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CE/CS304.1	3	3	2		1				1	1		
CE/CS304.2	3	2							1	1		
CE/CS304.3	2	3			1				1	1		
CE/CS304.4	2	2	2		1				1	1		

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
CE/CS304.1							
CE/CS304.2							
CE/CS304.3							

CE/CS304.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
✔	✔	✔	✔		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Sets, Relations and Languages**	1,5	**3**
	1.1	Relations and functions		
	1.2	Alphabets and languages		
	1.3	Types of proof		
2	**Title**	**Finite Automata**	1,3,5	**7**
	2.1	Regular languages and regular expressions		
	2.2	Finite Automata, Nondeterministic Finite Automata, Nondeterministic Finite Automata with **ϵ**-transitions		
	2.3	Kleene's theorem		
	2.4	NFA to DFA Conversion		
	2.5	Finite Automata with output (Moore and Mealy Machine)		
3	**Title**	**Regular Languages**	1,4	**6**
	3.1	The pumping lemma for regular languages, Applications of the pumping lemma		
	3.2	Closure properties for regular languages		
	3.3	Equivalence and minimization of automata: Testing equivalence of states, Minimization of DFA's		
	3.4	Myhill-Nerode theorem		
4	**Title**	**Context-Free Grammars and Languages**	1,5	**5**
	4.1	Context free grammars: Definition of context free grammars, Derivations using a grammar, The language of a grammar, Sentential forms		
	4.2	Parse trees: Constructing parse trees, From inferences to trees, From trees to derivations, From derivations to recursive inferences		
	4.3	Ambiguity in grammars and languages: Ambiguous grammars, Removing ambiguity from grammars		
5	**Title**	**Pushdown Automata**	1,2	**6**
	5.1	Definition of the pushdown automaton: The formal definition of pushdown automata, A graphical notation for PDA's, Instantaneous descriptions of a PDA		
	5.2	The languages of a PDA: Acceptance by final state, Acceptance by empty stack, From empty stack to final state, From final state to empty stack		

	5.3	Equivalence of PDA's and CFG's: From grammars to pushdown automata, From PDA's to Grammar		
	5.4	Deterministic pushdown automata: Definition of a deterministic PDA, Regular languages and deterministic PDA's, DPDA's and context free languages		
6	**Title**	**Properties of Context-Free Languages**	1,2,3	**5**
	6.1	Eliminating useless symbols, Computing the generating and reachable symbols, Chomsky normal form, Greibach normal form		
	6.2	The Pumping lemma for context free languages: Applications of the pumping lemma for CFL's		
7	**Title**	**Introduction to Turing Machines**	1,2,	**6**
	7.1	Turing machines: Formal definition of a Turing machine, Examples of Turing machines		
	7.2	Halting Problem, Post Correspondence Problem (PCP)		
	7.3	Variants of Turing machines: Multitape Turing Machines		
	7.4	Church-Turing hypothesis		
8	**Title**	**Recursively Enumerable Languages**	3	
	8.1	Recursively Enumerable and recursive		**4**
	8.2	Enumerating a language		
	8.3	Context sensitive languages and the Chomsky hierarchy		
	Self Study	**Tractable and Intractable Problems:** Tractable and Possibly Intractable Problems: P and NP, Polynomial-Time Reductions and NP-Completeness, Cook's Theorem	3	**5***
Total (*Not included)				**42**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Introduction to Automata Theory, Languages, and Computation	Third	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman	Pearson	2008
2	Introduction to the Theory of computation	Third	Michael Sipser	Cengage	2013

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
3	Introduction to Languages and the Theory of Computation	Fourth	John C. Martin	McGraw-Hill	2010
4	Elements of the Theory of Computation	Second	Harry R. Lewis, Christos H. Papadimitriou	Pearson	2015
5	Automata and Computability	--	Dexter C. Kozen	Springer	1997