

Branch Name:	Bachelor of Technology (COMPUTER ENGINEERING)
Program Code:	ET103
Semester/Year:	Semester VI/ Third Year
Course Title:	Theory of Computation
Course Code:	2ET1030602T
Pre-requisite Course:	Basic understanding of Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

1. Apply basic Mathematical concepts to design the basic Computational models
2. Understand formal language theory and design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and convert regular language to Regular expression using concept.
4. Design context free grammars for context free language and convert them into normal forms.
5. Design simple computational machines using Pushdown Automata and Turing Machines for CFL and higher class languages.
6. Differentiate, design and understand the fundamental concepts of Theory of Computation in the computer Science to solve computational problems

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Unit No	Topics	Total Hours	Weightage (%)
1	Review of Basic Mathematical Theory: Sets, Functions, Logical statements, Proofs, relations, languages, Mathematical induction, Recursive definitions.	04	12
2	Regular Languages and Deterministic Finite Automata: Regular languages, Regular expressions. Deterministic Finite automata: definition, and construction, union, intersection and complement of regular languages, recursive definition of FA, Minimization of Finite automata, Regular and Non Regular Languages– pumping lemma. FA with output: Moore and Mealy machines - Definition, inter-conversion	09	18
3	Non Deterministic Finite Automata: NFA: Definition, Recursive definition of NFA, conversion of NFA to FA. NFA- $\wedge$: Definition, Recursive definition, conversion of NFA- $\wedge$ to NFA, NFA- $\wedge$ to FA, RE to NFA	05	16
4	Context free grammar (CFG): Introduction of Non Regular Languages, CFG Definition and Examples, Derivation, parse trees, Ambiguous and Unambiguous CFG and Removal of Ambiguity, Simplification of CFG, Chomsky Normal Form-CNF, Conversion of CFG to CNF	05	16
5	Pushdown Automata and CFL: Introduction to PDA, Definition, Construction of Deterministic PDA and Non Deterministic PDA. Equivalence of PDAs and CFGs, Introduction of CFL, intersection and complements of CFL and Non-CFL	05	14
6	Cleaning the Grammar Remove useless productions, Left Factoring, Left Recursion Introduction to Top Down parsing and Bottom Up parsing Recursive Descent parser, Operator precedence Parser	04	14

7	Turing Machine (TM): TM Definition and Construction of Turing Machines. Languages of TM, computing functions with TM, Church Turing Thesis, Non-deterministic TM, Universal TM, Comparison And Applications of DFA, PDA and TM.	04	10
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Text Books:

1. Introduction to Languages and the Theory of Computation, 4th by John Martin, Tata Mc Graw Hill

Reference Books:

1. Introduction to Automata Theory, Languages, and Computation By John Hopcroft, Rajeev Motowani and Jeffrey Ullman
2. An introduction to automata theory and formal languages By Adesh K. Pandey, Publisher: S.K. Kataria & Sons.
3. Introduction to the Theory of Computation By Michael Sipser, PWS Publishing.
4. Computation: Finite and Infinite By Marvin L. Minsky Prentice-Hall
5. Compiler Design By Alfred V Aho, Addison Wesley

List of Open-Source Software/learning website:

1. <https://nptel.ac.in/courses/106/104/106104028/>
2. <https://www.javatpoint.com/automata-tutorial>
3. <https://www.geeksforgeeks.org/introduction-of-theory-of-computation/>
4. http://www.vssut.ac.in/lecture_notes/lecture1428551440.pdf

Course Learning Outcomes (CLO):

Course Outcomes	Description	Bloom's Taxonomy Level
CLO1	Understand mathematics concepts and use concepts in solving computational models	Understanding (2) Applying (3)
CLO2	Design regular expression and finite Automata for regular languages and validate using set of strings of a language	Understanding (2) Applying (3)
CLO3	Understand the concept of Non Deterministic Machine and convert NFA to DFA	Understanding (2) Applying (3)
CLO4	Design context free grammars for context free language, non-regular languages and understand the difference between ambiguous and Unambiguous Grammar and convert them into normal forms.	Understanding (2) Applying (3)
CLO5	Understand the concepts of higher class languages, CFL and implement using Pushdown Automata	Understanding (2) Applying (3)
CLO6	Understanding the technique of parsing discuss its applications	Understanding (2) Applying (3)
CLO7	Learn the concepts of Turing Machines and Compare different models of Automata in terms of memory and computation power,	Understanding (2) Applying (3)

Mapping of CLO with PO and PSO

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H	M	M									M				
CLO2	M	H	H	H	M							L		M		
CLO3	M	H	H	H	M							L		M		
CLO4	M	H	H	H	M							L		M		

CLO5	M	H	H	H	M							L		M		
CLO6	M	H	H	H	M							L		M		
CLO7	H	H	H	M	M									L		

H: High, M: Medium, L: Low