

Branch Name:	Artificial Intelligence & Data Science/ Information and Communication Technology
Program Code	ET108/ ET107
Semester/Year:	Semester V/ Third Year
Course Name:	Theory of Computation
Course Code:	2ET1070506T
Pre-requisite:	Calculus, Data Structures and Algorithms

Course Objectives:

1. It is used for advanced knowledge of formal computation and its relationship to languages.
2. This course will teach you how to distinguish different computing languages and classify their respective types.
3. It is used to Recognize and comprehend formal reasoning about languages.
4. It Show a competent understanding of the basic concepts of complexity theory

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

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Review of Mathematical Theory: Sets, Functions, Logical statements, Proofs, Relations, Languages, Mathematical Induction, Strong Principle, Recursive Definitions	04	10
2	Regular Languages and Finite Automata: Regular expressions, regular languages, applications, Automata with output-Moore machine, Mealy machine, Finite automata, memory requirement in a recognizer, definition, union, intersection and complement of regular languages. Non Determinism Finite Automata, Conversion from NFA to FA, ?- Non Determinism Finite Automata Conversion of NFA- ? to NFA and equivalence of three Kleene's Theorem, Minimization of Finite automata Regular And Non Regular Languages – pumping lemma.	07	25
3	Context free grammar (CFG): Definition, Unions Concatenations And Kleen's of Context free language Regular grammar, Derivations and Languages, Relationship between derivation and derivation trees, Ambiguity Unambiguous CFG and Algebraic Expressions BacosNaur Form (BNF), Normal Form – CNF	07	20

4	Pushdown Automata, CFL And NCFL: Definition, deterministic PDA, Equivalence of CFG and PDA, Pumping lemma for CFL, Intersections and Complements of CFL, Non-CFL	05	10
5	Turing Machine (TM): TM Definition, Model of Computation and Church Turning Thesis, computing functions with TM, Combining TM, Variations Of TM, Non Deterministic TM, Universal TM, Recursively and Enumerable Languages, Context sensitive languages and Chomsky hierarchy	06	25
6	Computable Functions: Partial - Total - Constant Functions, Primitive Partial, total, constant functions, Primitive Recursive Functions, Bounded Mineralization, Regular function, Recursive Functions	05	10

List of Reference Books:

1. An Introduction to Automata Theory & Formal Languages by Adesh K. Pandey , S.K. Kataria & Sons, 6th 2022
2. Computation: Finite and Infinite Machines by Marvin Lee Minshy, 1 December 1967
3. Introduction to Computer Theory by Daniel I.A. Cohen, Second Edition, 1 January 2007
4. Introduction to Automata Theory, Languages, and Computation
by John Hopcroft | Jun 29, 2006

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Use the concepts and techniques of discrete mathematics for theoretical computer science.	3 Applying 4 Analyzing
CLO2	Identify different formal languages and their relationship.	5 Evaluating
CLO3	Classify and construct grammars for different languages and vice-versa.	4 Analyzing 2 Understanding
CLO4	Build finite automata, push down automata and turing machine.	3 Applying
CLO5	Analyze various concepts of undecidability and Computable Function and Discuss analytically and intuitively for problem-solving situation.	2 Understanding

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CLO1	H	M		L	M					L	L		M	M	H	
CLO2	H	M	M	H	M	L		L		M			M	H		
CLO3	M	H	H	H	M					L			H	H		L
CLO4	M	H	H	L			M		M				H	H	H	
CLO5	M	M	M	H	L					M			H	H	H	

H: High, M: Medium, L: Low