

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

(AUTONOMOUS)
 (Approved by AICTE & Affiliated to Anna University, Chennai)
 Accredited with 'A' Grade by NAAC, Accredited by TCS
 Accredited by NBA with BME, ECE & EEE
PERAMBALUR - 621 212. Tamil Nadu.
 website : www.dsengg.ac.in

**COURSE PLAN (2024-2025 ODD SEM)**

Name of the Faculty				
Designation/Department	AP/IT			
Course Code/Name	U20IT503/THEORY OF COMPUTATION			
Year/Section/Department	III/-/IT			
Credits Details	L:4	T:0	P:0	C:4
Total Contact Hours Required	60			

Syllabus:

UNIT I AUTOMATA FUNDAMENTALS	No. of Periods 12
Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions	
UNIT II REGULAR EXPRESSIONS AND LANGUAGES	No. of Periods 12
Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata.	
UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES	No. of Periods 12
CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.	
UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES	No. of Periods 12
Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM.	
UNIT V UNDECIDABILITY	No. of Periods 12
Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem, The Class P and NP.	

Objective:

- ❖ To understand the language hierarchy.
- ❖ To construct automata for any given pattern and find its equivalent regular expressions
- ❖ To design a context free grammar for any given language.
- ❖ To understand Turing machines and their capability.
- ❖ To understand undecidable problems and NP class problems.

Text Book:

T1: J.E.Hopcroft, R.Motwani and J.D Ullman, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2003.

Reference Book:

R1: H.R.Lewis and C.H.Papadimitriou, “Elements of the theory of Computation”, Second Edition, PHI, 2003.

R2: J.Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, TMH, 2003.

R3: Micheal Sipser, “Introduction of the Theory and Computation”, Thomson Brokecole, 1997.

Website:

W1: <https://www.slideshare.net/mobile/mukeshnt/finite-automata-presentation>

W2: https://www.tutorialspoint.com/automata_theory/deterministic_finite_automaton.htm

W3: <https://www.educative.io/answers/what-are-the-closure-properties-of-regular-languages>

W4: <https://www.javatpoint.com/pushdown-automata>

W5: <https://www.geeksforgeeks.org/recursive-and-recursive-enumerable-languages-in-toc>

Online Mode of Study (if Any):

❖ https://onlinecourses.nptel.ac.in/noc21_cs83

Course Plan:

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
UNIT I AUTOMATA FUNDAMENTALS						
1	Introduction to formal proof	T1	5-13	BB	1	1
2	Additional forms of Proof	T1	13-19	BB	1	2
3	Inductive Proofs	T1	19-26	BB	1	3
4	Finite Automata	W1	-	-	1	4
5	Finite Automata	W1	-	-	1	5
6	Deterministic Finite Automata	W2	-	-	1	6
7	Non-deterministic Finite Automata	T1	55-66	BB	2	8
8	Finite Automata with Epsilon Transitions	T1	72-76	BB	2	10
9	Finite Automata with Epsilon Transitions	T1	76-80	BB	2	12
Outcome of Unit I:						
CO1: Construct automata and Epsilon Transitions.						

UNIT II REGULAR EXPRESSIONS AND LANGUAGES						
10	Regular Expressions	T1	83-89	BB	2	14
11	FA and Regular Expressions	T1	90-106	BB	2	16
12	Proving Languages not to be regular	T1	125-127	BB	2	18
13	Closure Properties of Regular Languages	W3	-	-	2	20
14	Equivalence and Minimization of Automata.	T1	154-162	BB	2	22
		T1	162-165	BB	2	24
Outcome of Unit II: CO2: Outline regular expression of string pattern.						
UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES						
15	CFG	T1	169-179	BB	1	25
16	Parse Trees	T1	181-191	BB	1	26
17	Ambiguity in Grammars and Languages	T1, R2	205-216, 134-148	BB	2	28
18	Definition of the Pushdown Automata	W4	-	-	2	30
19	Languages of a Pushdown Automata	T1	229-236	BB	2	32
20	Equivalence of Pushdown Automata and CFG	T1	237-245	BB	2	34
21	Deterministic Pushdown Automata	T1	246-249	BB	2	36
Outcome of Unit III CO3: Apply context free grammar for any language.						
UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES						
22	Normal Forms for CFG	T1	255-258	BB	2	38
23	Pumping Lemma for CFL	T1	274-280	BB	2	40
24	Closure Properties of CFL	T1	281-285	BB	2	42
25	Turing Machines	T1,R3	316-320, 124-146	BB	2	44
26	Programming Techniques for TM.	T1	329-331	BB	2	46
27	Programming Techniques for TM.	T1	332-335	BB	2	48
Outcome of Unit IV: CO4: Apply Turing machine to propose computation solutions.						

UNIT V		UNDECIDABILITY				
28	Non Recursive Enumerable(RE) Language	W5	-	-	2	50
29	Undecidable Problem with RE	T1	367-370	BB	2	52
30	Undecidable Problems about TM	T1	373-382	BB	2	54
31	Post's Correspondence Problem	T1	392-403	BB	3	57
32	The Class P and NP.	T1	413-419	BB	3	60
Outcome of Unit V:						
CO5: Interpret whether a problem is decidable or not.						
CO6: Interpret NP class problems.						

Course Outcome:

At the end of course: Students should be able to do: CO1. Construct automata and Epsilon Transitions. CO2. Outline regular expression of string pattern. CO3. Apply context free grammar for any language. CO4. Apply Turing machine to propose computation solutions. CO5. Interpret whether a problem is decidable or not. CO6. Interpret NP class problems.

Course Outcome Vs Program Outcome Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	1	-	1	-	-	2	2
CO2	2	1	-	2	-	-	-	1	-	1	-	-	2	2
CO3	3	2	1	1	-	-	-	1	-	1	-	-	2	2
CO4	3	2	1	1	-	-	-	1	-	1	-	-	2	2
CO5	2	1	-	2	-	-	-	1	-	1	-	-	2	2
CO6	2	1	-	2	-	-	-	1	1	1	-	-	2	2
AVG	2.5	1.5	1	1.6	-	-	-	1	1	1	-	-	2	2

Content beyond Syllabus:

❖ Real World Applications of Automaton Theory

Assignment Detail:

Assignment No.	Mode of Assignment Written /Seminar/PPT	Topics	Cos	RBT
Assignment - 1	Written	1. Converting NFA to DFA with an example. 2. Explain Minimization of Automata with an example.	CO1 CO2	K3 K3
Assignment - 2	Seminar	1. Equivalence of Pushdown Automata and CFG 2. Explain Programming Techniques for TM.	CO3 CO4	K3 K3
Assignment - 3	PPT	3. Elaborate Universal Turing machine and Rice Theorem 4. Explain Class P and NP Problems	CO5 CO6	K3 K3

Submission Details:

Phase 1(Before AT 1)	Phase 2 (Before AT 2)	Phase 3 (Before AT 3)
Assignment 1	Assignment 2	Assignment 3

Google Class Code Details:**Prepared By****(AP/IT)****Verified By****(HOD/IT)****Approved By
PRINCIPAL**