Syllabus: CSE 251, Theory of Computation

School: SSCSE		**Batch: 2024-28**	
Program: B.Tech		**Current Academic Year: 2025-26**	
Branch: CSE		**Semester: IV**	
1	Course Code	CSE-251	Course Name: Theory of Computation
2	Course Title	Theory of Computation	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status		
5	Course Objective	The goal of this course is to provide students with an understanding of basic concepts in the theory of computation.	
6	Course Outcomes	Students will be able to: **CO1: Formulate** the concept of Automata and related terminology. **CO2: Design** DFA and NDFA and conversion from NDFA to DFA. **CO3: Construct** finite automata without output and with output. **CO4: Implement** regular expression and grammar corresponding to DFA and vice-versa **CO5: Design** Push down Automata from Context Free Language or Grammar and vice-versa. **CO6: Design** Turing Machine for computational problems, Develop a clear understanding of un-decidability.	
7	Course Description	The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.	
8	Outline syllabus		CO Mapping
	Unit 1	**Finite Automata**	
	A	Introduction to languages, Kleene closures, Finite Automata (FA), Transition graph, Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA).	CO1, CO2
	B	Equivalence of NDFA and DFA, Construction of DFA from NFA and optimization of Finite Automata.	CO1, CO2
	C	Applications and Limitation of FA. (FAT tool).	CO1, CO2
	Unit 2	**Regular Expression and Finite Automata**	
	A	Regular Expression, Finite Automata with null move, Regular Expression to Finite Automata.	CO1, CO2,CO4
	B	Arden Theorem, Pumping Lemma for regular expressions.	CO1, CO2,CO4
	C	FA with output: Moore machine, Mealy machine and Equivalence.	CO1, CO2,CO3

	Unit 3	**REGULAR & CONTEXT FREE LANGUAGE**	
	A	Defining grammar, Chomsky hierarchy of Languages and Grammar. Ambiguous to Unambiguous CFG.	CO4
	B	Simplification of CFGs.	CO4
	C	Normal forms for CFGs, Pumping lemma for CFLs.	CO4
	Unit 4	**PUSH DOWN AUTOMATA**	
	A	Description and definition of PDA and Non-Deterministic PDA, Working of PDA.	CO5
	B	Acceptance of a string by PDA with final state and with Null store. Two stack PDA.	CO5
	C	Conversion of PDA into CFG, Conversion of CFG into PDA.	CO5
	Unit 5	**TURING MACHINE**	
	A	Turing machines (TM): Basic model, definition and representation, Language acceptance by TM.	CO6
	B	Turing machine as a computational machine, Halting problem of TM, Universal TM (Visual Turing machine).	CO6
	C	Modifications in TM, Undecidability of Post correspondence problem, Church's Thesis, Godel Numbering.	CO6
	Mode of examination	Theory	

		CA				ETE	
	Weightage Distribution	Assessment 1 (10)	Assessment 2 (5)	Assignment 1 (5)	Assignment 2 (5)	75	

	Text book/s*	1. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science(Automata, Languages and Computation)", PHI	
	Other References	1.Peter Linz, "Formal Languages and Auomata", Narosa Publishing House 2.Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Narosa Publishing House	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Formulate the concept of Automata and related terminology.	PO1,PO2,PO3,PO4,PO5, PO9,PSO1,PSO2
2.	**CO2:** Design DFA and NDFA and conversion from NDFA to DFA.	PO1, PO3, PO4, PO5, PO9, PSO2, PSO3
3.	**CO3:** Construct finite automata without output and with output.	PO1,PO2,PO3,PO4, PO9,PSO1,PSO2
4.	**CO4:** Implement regular expression and grammar corresponding to DFA and vice-versa	PO1,PO2,PO3, PO5,PO9, PSO3
5	**CO5:** Design Push down Automata from Context Free Language or Grammar and vice-versa .	PO1,PO2,PO3,PO4, PO5, PO9,PSO1,PSO2,PSO3

6	**CO6:** Design Turing Machine for computational problems,Develop a clear understanding of un-decidability.	PO1,PO2,PO3,PO4,PO5PO9, PSO1, PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Theory of Computation **(Course Code CSE251)**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	--	--	--	3	--	--	3	2	--
CO 2	3	--	3	3	2	--	--	--	2	--	--	--	3	2
CO 3	3	3	3	3	--	--	--	--	2	--	--	3	2	--
CO 4	2	2	2	--	2	--	--	--	3	--	--	--	--	3
CO 5	3	3	3	3	3	--	--	--	--	--	--	3	2	2
CO 6	3	2	3	3	3	--	--	--	2	--	--	3	3	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CSE251	TOC	2.8	2.1	2.8	2.5	2	0	0	0	2	0	0	2	2	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***