Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 402 Course Title: **Finite Automata and Formal Languages**
2. Contact Hours: L: 3 T: 1 P: 0
3. Semester: IV

4. Pre-requisite: TMA 101, TMA 201

5. Course Outcomes: After completion of the course students will be able to

1. Demonstrate the conversion of NFA into DFA, ϵ-NFA into DFA and Minimization of Finite Automata by using Myhill-Nerode Theorem
2. Formulate DFA, RE and FA with output.
3. Design CFG and check the language is not CFL.
4. Design PDA and convert n-PDA into d-PDA.
5. Design Turing machines for addition, substraction, multiplication etc.
6. Formulate finite machines, push down automata and Turing machines for automated functioning of devices.

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit – I	Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem	**10**
Unit - II	Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.	**10**
Unit – III	Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.	**9**
Unit – IV	Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.	**10**

Unit – V	Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.	**8**
	Total	**47**

Text Book:

- Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
- KLP Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.

Reference Books:

- Michael Sipser," Introduction to Theory of Computation", (2nd edition), Thomson, 2006
- Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
- Elaine Rich , "Automata, Computability, Complexity-Theory and applications"