

# PARUL UNIVERSITY - FACULTY OF ENGINEERING & TECHNOLOGY

## DEPARTMENT OF INFORMATION TECHNOLOGY SYLLABUS (PROPOSED) FOR 5<sup>th</sup> B. TECH. PROGRAMME Theory of Computation

**Type of Course:** B.Tech

**Prerequisite:** Knowledge in mathematics, including a course in discrete mathematics, and in programming

**Rationale:** To introduce students the basic concepts in theoretical computer science, and the formal relationships among machines, languages and grammars and computational problems. The course should in addition clarify the practical view towards the applications of these ideas in engineering

**Teaching and Examination Scheme:**

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory E	Practical V	Theory M	*C.E	Practical P.A	
3	0	0	3	60	0	20	20	0	100

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; E - End Semester Theory Exam; V - End Semester Viva Exam; M – Mid Semester Exam; P.A.- Progressive Assessment;

**Contents:**

Sr. No.	Topic	Weightage	Teaching Hrs.
1	AUTOMATA FUNDAMENTALS Introduction to formal proof — Additional forms of Proof — Inductive Proofs –Finite Automata — Deterministic Finite Automata — Non-deterministic Finite Automata — Finite Automata with Epsilon Transitions	15%	6
2	UNIT II REGULAR EXPRESSIONS AND LANGUAGES Regular Expressions — FA and Regular Expressions — Proving Languages not to be regular — Closure Properties of Regular Languages — Equivalence and Minimization of Automata.	25%	10
3	UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES CFG — Parse Trees — Ambiguity in Grammars and Languages — Definition of the Pushdown Automata — Languages of a Pushdown Automata — Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.	25%	10
4	UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES Normal Forms for CFG — Pumping Lemma for CFL — Closure Properties of CFL — Turing Machines — Programming Techniques for TM.	20%	8
5	UNIT V UNDECIDABILITY Non Recursive Enumerable (RE) Language — Undecidable Problem with RE — Undecidable Problems about TM — Post's Correspondence Problem, The Class P and NP.	15%	6

**\*C.E-Continuous Evaluation:** It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc

**Suggested books:**

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

**Suggested reference books:**

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata Mc GrawHill.

**Online Learning Resources**

List of Open Source Software/learning website: 1. [http://en.wikipedia.org/wiki/Theory\\_of\\_computation](http://en.wikipedia.org/wiki/Theory_of_computation) 2. <http://meru.cecs.missouri.edu/courses/cecs341/tc.html> 3. <https://www.coursera.org/courses?query=theory%20of%20computation> 4. [nptel.ac.in/courses/106104028/theory of computation](http://nptel.ac.in/courses/106104028/theory_of_computation). 5. <https://lagunita.stanford.edu/courses/course-v1:ComputerScience+Automata+SelfPaced/about>

**Course Outcome:**

After successful completion of this course, students will be able to

1. Apply the knowledge of automata theory, grammars & regular expressions for solving the problem
2. Analyze the give automata, regular expression & grammar to know the language it represents
3. Design Automata & Grammar for pattern recognition and syntax checking
4. To distinguish between decidability and undecidability of problems
5. Identify limitations of some computational models and possible methods of proving them