PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Computer Science & Engineering

SYLLABUS FOR 5th Sem BTech PROGRAMME

Theory of Computation (203108301)

Type of Course: BTech

Prerequisite: Knowledge of Set Theory, Relations and Functions, Data Structure

Rationale: Theory of Automata teaches how efficiently problems can be solved using an algorithm. Finite state machines can help in all the computing of emerging area

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/	Tut Hrs/	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Introduction:**: Introduction to Formal Languages and Automata,Alphabet,languages and grammars, productions and derivation, Chomsky hierarchy oflanguages.	5%	2
2	**Regular languages and finite automata:**: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.	20%	8
3	**Grammars:**: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	30%	8
4	**Turing machines:**: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs asenumerators.	20%	8

5	**Undecidability:**: Church Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.	15%	4

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

Reference Books:

1. Introduction to Automata theory, languages and Computation (TextBook)
   John E. Hopcroft, Rajiv Motwani and Jeffery D. Ullman; Pearson
2. Elements of the Theory of Computation
   Harry R.Lewis and Christos H. Papadimitriou; Pearson Education Asia
3. Automata and Computability
   Dexter C. Kozen; Undergraduate Texts in Computer Science, Springer
4. Introduction to the Theory of Computation
   Michael Sipser; PWS Publishing
5. Introduction to Languages and the Theory of Computation
   John C. Martin; McGraw Hill

Course Outcome:

After Learning the course the students shall be able to:

1. Write a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. For a given language determine whether the given language is regular or not.
4. Design context free grammars to generate strings of context free language.
5. Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
6. Write the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.