Subject Name: Theory of Computation

Subject Code: CE 604 / IT 604

Teaching Scheme (Credits and Hours)

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
03	00	00	03	3	3	70	30	20	-	120

Learning Objectives:

The theoretical foundations of computer science have expanded substantially in recent years. The objective of this course is to introduce students to this fundamental area of computer science which enables students to focus on the study of abstract models of computation. These abstract models allow the students to assess via formal reasoning what could be achieved through computing when they are using it to solve problems in science and engineering. The course exposes students to the computability theory, as well as to the complexity theory. The goal is to allow them to answer fundamental questions about problems, such as whether they can or not be computed, and if they can, how efficiently. The course introduces basic computation models and their properties, and the necessary mathematical techniques to prove more advanced attributes of these models. The students will be able to express computer science problems as mathematical statements and to formulate proofs. Upon completion of this course the students are expected to become proficient in key topics of theory of computation, and to have the opportunity to explore the current topics in this area.

Outline of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	Introduction to theory of computation and basic Mathematical objects	3
2	Mathematical Induction and Recursive definition.	4
3	Regular Language and Finite automata.	12
4	Regular and Non regular Languages.	4
5	Context Free Grammars and Pushdown Automata.	14
7	Turing machines	5
8	Introduction to Recursively Enumerable Languages and Computable Functions	3

Total hours (Theory): 45

Total hours (Lab): 0

Total hours: 45

Detailed Syllabus

Sr. No	Topic	Lecture Hours	Weightage(%)
1	**Introduction to theory of computation and basic Mathematical objects:** Sets, Logic, Function, Relation, Languages	3	5
2	**Mathematical Induction and Recursive definition.** Types of proof, The Principle of Mathematical Induction, The Strong principle of Mathematical Induction, Recursive Definition, Structural Induction.	4	10
3	**Regular Language and Finite automata.** Regular Languages and Regular expressions, Finite automata and Memory required to recognize a Language, Distinguishing one string from another, Union, Intersections and Complements, Non deterministic Finite Automata, Non deterministic Finite Automata with ^ - transition, Kleens theorms, Conversions from NFA-^ to NFA,NFA to DFA	12	30
4	**Regular and Non regular Languages.** A Criterion for Regualarity, Minimal Finite Automata, The Pumping Lemma for Regular Languages, Decision Problems,	4	10
5	**Context Free Grammars and Pushdown Automata.** Introduction to grammars, Derivation trees and Ambiguity, An unambiguous CFG for Algebric Expressions,Simplified Forms and normal Forms.Definations,Deterministics Push down Automata,A PDA corresponding to Given Grammar, A CFG corresponding to given PDA, Introduction to Parsing. Introduction to Puming lemma for Context free Languages	14	30
6	**Turing machines** Definitions and ExamplesCombining turing machines, Multitape TM, Universal Turing Machines – Halting Problem of Turing Machines – Church's Thesis	5	10
7	**Introduction to Recursively Enumerable Languages and Computable Functions** Definitions	3	5
	Total	**45**	**100**

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

On successful completion of the course, the student will:

- Be familiar with Regular and Non regular Language and Finite automata.
- Examine the properties of formal language and automata, their equivalence and conversion techniques.
- Understand the concept of Context Free Grammars and Pushdown Automata.
- Be familiar with Turing machines

Text Books:

Theory of Computation by John C Martin.

Reference Books:

Theory of Computation by V Sarthi.
Formal Languages and automata theory by C K Nagpal.