Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ Practical	Tutorial	Total
SEITC404	Automata Theory	03	--	01	03	--	01	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
SEITC404	Automata Theory	20	20	20	80	25	---	--	125

Course Objectives:

To build up mathematical fundamentals required to understand the theory of computation

1. To formalize mathematical models of computation: basic machines, deterministic and non deterministic machines and pushdown machines and Turing Machines.
2. To learn fundamentals of formal grammars and languages.
3. Develop understanding of different types of Turing machines, their use, capabilities & limitations.
4. Understand the concept of Undecidability

Course Outcomes: After completing the course successfully, students will be able to:

1. Design different types of machines.
2. Compare different types of languages and machines
3. Use the pumping lemma and closure properties to prove that some problems cannot be solved by particular machines.
4. Understand Power and Limitations of theoretical models of Computation.
5. Match constraints of a language to power of machines.

Detailed Syllabus:

Sr. No	Detail contents	Number of Hours
1.	**Basic Mathematical Fundamentals:** Sets, Logic, Functions, Relations and Languages, pigeonhole principle, mathematical induction.	02
2.	**Introduction and Finite Automata:** Alphabets, Strings, Languages, Finite Automata (FA), acceptance of strings, and languages, Deterministic Finite Automata (DFA) and Non Deterministic Finite Automata (NFA), transition diagrams and Language recognizers. Conversions and Equivalence: Equivalence between NFA with and without ε- transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Mealy machines.	06
3.	**Regular Expressions & Languages:** FA and Regular Expressions, Conversion from RE to FA and FA to RE, Pumping lemma for regular languages, Closure properties of regular languages, Equivalence and minimization of Automata.	05
4.	**Context Free Grammars and Languages:** CFG, Leftmost, Rightmost derivations, Ambiguity in grammars and languages. Simplification of Context Free Grammars, Chomsky normal form (CNF), Greiback normal form (GNF), Pumping Lemma for Context Free Languages.	04
5.	**Push Down Automata:** Definition and languages of PDA, Equivalence& conversion of CFG's and PDA's, Deterministic PDA.	06
6.	**Turing Theory:** Turing Machines, definition, model, design of TM, Variations of TM: Multitape TMs, Non Deterministic TM, Universal TM, The Church-Turing thesis.	08
7.	**Undecidability and Recursively enumerable languages: Recursive and** Recursively enumerable languages, Context-Sensitive Languages and the Chomsky Hierarchy. Unsolvable Problems: Halting Problem, Post's Correspondence Problem (PCP).	05

TERM WORK

Journal work should comprise of writing 10 assignments based on the above syllabus.
Use of JFLAP software is desirable for experimenting with formal languages: topics including nondeterministic finite automata, nondeterministic pushdown automata, multi-tape Turing machines, several types of grammars.

TEXT BOOKS

1. Kavi Mahesh, **"Theory of Computation A Problem Solving Approach"**, Wiley India

2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, **"Introduction to Automata Theory, Languages and Computation",** Pearson Education.

3. J.C.Martin, **"Introduction to languages and the Theory of Computation"**, TMH.

REFERENCES

1. Daniel I.A. Cohen, "**Introduction to Computer Theory"**, John Wiley & Sons.

2. Michael Sipser, **"Theory of Computation",** Cengage Learning.

3. N.Chandrashekhar& K.L.P. Mishra, "Theory of Computer Science, Automata Languages & Computations", PHI publications.

Theory Examination:

- Question paper will comprise of 6 questions, each carrying 20 marks.
- Total 4 questions need to be solved.
- Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
- Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.