Course No.	Course Name	L-T-P - Credits	Year of Introduction
IT303	Theory of Computation	3-0-0-3	2016

Pre-requisites: Nil

Course Objectives

- To study computing machines and their capabilities
- To impart the basic concepts of theory of automata, languages and computation.
- To develop a model for that computers manipulate the data.
- To develop understanding about machines for sequential recognition and computation
- To understand and classify formal languages and grammars

Syllabus

Introduction: Formal representation of languages – Chomsky Classification, Introduction to Automata theory, NFA , DFA, Regular Expressions,–Conversion of NFA to DFA – Finite automata with output-Moore and Mealy machines– Finite Automation with ∈-Transitions Minimisation of DFA-DFA to Regular Expressions conversion, Applications of finite automata , Context Free Grammar – Derivation trees, ambiguity, simplification of CFLs, normal forms of CFGs. PDA – formal definition, examples of PDA, Deterministic PDA. Pumping lemma for CFGs, closure properties of CFLs, decision algorithms for CFGs. Turing machines, formal definition of Turing Machine, language acceptability by TM, examples of TM. Variants of TMs – multitape TM, Non-deterministic TM, offline TMs, equivalence of single tape and multitape TMs. Module – IV Recursive and recursively enumerable languages – properties recursive and r.e. languages. Decidability - decidable and undecidable problems, Universal Turing Machine, halting problem, reducibility

Expected outcome .

- The student will be able to model different automata that accepts appropriate languages.

Text Book:

1. Hopcroft J. E., J. D. Ullman and R. Motwani, Introduction to Automata Theory, Languages and Computation, Pearson Education, 2008
2. Misra and Chandrasekharan, Theory of Computation, Prentice Hall

References:

1. John Martin, Introduction to Language and Theory of Computation, TMH
2. K.V.N. Sunitha and N Kalyani, Formal languages and Automata Theory Tata McGraw Hill, NewDelhi,
3. Michael Sipser, Introduction to the Theory of Computation, Thomson Learning
4. Moret B. M., The Theory of Computation, Pearson Education
5. Peter Linz, An Introduction to Formal Languages and Automata Narosa Publucation

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction: Formal representation of languages – Chomsky Classification, Introduction to Automata theory, Alphabets and Languages, language operations: Concatenation, sub string Kleene closure, Reversal, Finite state systems, Transition diagram and table	6	15%
II	Finite automata, Finite state automata – description of finite automata, language acceptability, designing finite automata, NFA, -. Difference between NFA&DFA finite automata with epsilon	8	15%

	moves, equivalence of NFA and DFA –Conversion of NFA to DFA - Minimisation of DFA-, Applications of finite automata, , Finite Automata with output. Moore and Meelay Machines.		
FIRST INTERNAL EXAMINATION			
III	Regular Expressions – Properties of Regular sets , Ardens theorem- DFA to Regular Expressions conversion,DFA construction for given regular expression ,Pumping Lemma , closure properties.	6	15%
IV	Context Free Grammar – Derivation trees, ambiguity, simplification of CFLs, normal forms of CFGs: Chomsky and Greibach NFs. PDA – formal definition, examples of PDA, , language acceptability ,Deterministic PDA. Pumping lemma for CFGs. Applications of PDA and CFLs	8	15%
SECOND INTERNAL EXAMINATION			
V	Turing machines - Chomsky classification of languages, formal definition of Turing Machine, language acceptability by TM, examples of TM. Variants of TMs – multitape TM, multiple tracks ,checking off symbols , Subroutines, Non-deterministic TM, offline TMs, Universal Turing Machine, equivalence of single tape and multitape TMs.	8	20%
VI	Linear bounded automata, Recursive and recursively enumerable languages – properties recursive and r.e. languages. Decidability - decidable and undecidable problems, tractable and intractable problems, halting problem, reducibility. Church Thesis	6	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks: 100 Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

Part A shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

Part B shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

Part C shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

Note : Each question can have a maximum of 4 subparts, if needed