**UNIVERSITY OF GUJRAT**

**CS-361: (Theory of Automata & Formal Languages)**

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| **Course Code: CS-361** | **Course Title: Theory of Automata & Formal Languages** |
| **Year: 2018** | **Semester: 5th** |
| **Instructor’s Name: Saliha Zahoor** | **Office (Room No): B207** |
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| **Course Description** | * The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, , pushdown automaton, and Turing machine. * Theory of Automata not only the basic models of computation also the foundation of many branches of computer science, e.g. compilers, software engineering,etc. |
| **Course Type:**  **(Compulsory/Core/Elective)** | Core |
| **Pre-requisites** | Discrete Structures |
| **Goals** | * The goal of this course is to make the students familiar with fundamental principles of computability. * To give them an insight into the theory and design of problem solving in conventional and modem computing machines. * To bring a practical approach in the students, so that they can initiate design and implement solution of a problem. * To give them the understanding of mathematical models of the computing machines. To understand the decidability and computability of the computational problems. * To make students able to practically implement the ideas gained in the subject of Modem programming languages. * To prepare students for the study of compiler construction. |
| **Books** | (1)“Introduction to Computer Theory”, Daniel I. A. Cohen |
| **Additional Readings** | (2) P. Linz. “Introduction to Formal Languages and Automata”  (3) Michael Sipser, Introduction to the Theory of Computation |
| **Lectures** | 32 |
| **Grading** | |  |  |  | | --- | --- | --- | | Sessional | Mid Term | Final Term | | 25% | 25% | 50% | |
| **Quizzes, Assignments and Presentation Schedule (tentative)** | 04 Quizzes , 04 Assignments, 01 Presentation |

**Session Schedule**

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| **Session** | **Topic** | **Readings** |
| Week 1 | Basic concepts of Finite Automata and Languages, word, null string, length of a string, reverse of a string, Palindrome, Kleene closure, Formal definition of Regular Expressions, Defining languages with regular expressions, Languages associated with regular expressions. Equivalent non Equivalent Regular Expressions | 1, 2 |
| Week 2 | Deterministic finite automaton, Non Deterministic | 1,2 |
| Week 3 | Differences between FA and NFA. More examples related to NFA. Transition Graphs with examples, Generalized Transition Graphs, Non-determinism in case of Transition Graphs. Equivalence between DFA and NFA | 1,2,3 |
| Week 4 | Kleene’s Theorem: Converting Regular Expressions into FA’s. Converting NFA into Regular Expression | 1 |
| Week 5 | Kleene’s Theorem: converting NFA into DFA, Properties of Regular Languages (i.e. Union, Concatenation, Kleene closure, Complements and Intersections) with examples. Decidability, decision procedure, Decision to prove whether two given RE’s or FA’s are equivalent. Checking whether languages are finite or infinite. | 1 |
| Week 6 | Non-Regular Languages, The pumping Lemma, | 1,2,3 |
| Week 7 | Finite Automata with output. Moore and Mealy Machines | 1 |
| Week 8 | Context-Fee Grammars and Languages, Grammar conversion into language ,Languages conversion into Grammars | 1,2,3 |
|  | **MID TERM** |  |
| Week 9 | Parsing (or derivation) Leftmost and Rightmost derivations , Parse Trees ,Total language tree, | 1,2,3 |
| Week 10 | Ambiguity of grammar and Languages, Unambiguous CFG’s. | 1 |
| Week 11 | Simplification of CFG’s. Killing Null productions, Killing unit productions, Killing of Useless Productions | 1,2 |
| Week 12 | Chomsky Normal Forms and Greinbach normal forms | 1,2 |
| Week 13 | Pushdown automaton (PDA), Various forms of PDA, Pushdown stack. DPDA, Nondeterministic PDA. | 1,2 |
| Week 14 | Equivalence between CFG and PDA, CFG = PDA,CFG Conversion to PDA, Context Free Languages, their Closure Properties, Union, Concatenation and Kleene Closures using CFG’s. | 1,2 |
| Week 15 | Turing machines, Turing Recognizable Languages, Halting Problem, and Defining Computers by TM’s. Computable Functions and (un)decidability | 1,2,3 |
| Week 16 | Final Revision |  |