**Military Institute of Science and Technology**
**Mirpur Cantonment, Dhaka**

**Department of Nuclear Science & Engineering (NSE)**

# COURSE OUTLINE

| Subject | Instructor |
|---|---|
| **Title:** Theory of Computation<br>**Code:** CSE-217<br>**Credit hr:** 3.00<br>**Contact hr:** 3.00<br>Level-2, Term-II | **Name:** Lec Zinia Sultana<br>**Email:** ziniasultana@cse.mist.ac.bd<br><br>**Name:** Lec Md. Jakaria<br>**E-mail:** jakaria@cse.mist.ac.bd |

**1.0 Rationale:**

To learn how problems can be efficiently solved on a model of computation using algorithms and the elementary ways in which a computer works.

**2.0 Course Objectives:**

1. Understand the mathematical foundations of computation including automata theory.
2. Have a solid foundation of the theory of formal languages and grammars.
3. Analyze and design finite automata, pushdown automata, Turing machines, formal languages and languages, and grammars.

**3.0 Course Outcomes:**

1. Identify the mathematical foundations of computation including automata theory.
2. Able to define the foundation of the theory of formal languages, grammars, notions of algorithm, decidability, complexity, and computability.
3. Correlate and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.
4. Enhance one's ability to explain and conduct mathematical proofs for computation and algorithms.

**4.0 Textbooks:**

Introduction to the Theory of Computation, 3rd edition, 2012- Michael Sipser.

**5.0 Reference Books:**

1. Introduction to Automata Theory, Languages, and Computation. Addison-Wesley Longman Publishing Co., Inc., 3rd ed., 2006 - J. E. Hopcroft, R. Motwani, and J. D. Ullman.
2. Elements of the Theory of Computation. Upper Saddle River, NJ, USA: Prentice Hall PTR, 2nd edition, 1997- H. R. Lewis and C. H. Papadimitriou.

**6.0 Distribution of Marks:**

| Description | Percentage |
|---|---|
| Class Participation / Observation | 05% |
| Class Test | 20% |
| Mid Term Exam | 15% |
| Final Examination (Section A & Section B) | 60% |
| **Total** | **100%** |

**7.0 Distribution (Planning) of the Course Contents:**

| Week | Lecture | Topics | Chapter | Remarks |
|---|---|---|---|---|
| **1** | Lec 1-3 | Automata, Computability, and Complexity, Mathematical Notation and Terminology, Sets, Sequences and Tuples, Functions and Relations, Strings and Languages, Definitions, Theorems and Proofs. | 0.1,0.2, 0.3 | Michael Sipser |
| **2** | Lec 4-6 | Finite Automata, Formal Definition of a Finite Automaton, Examples of Finite Automata, Formal Definition of Computation, Designing Finite Automata, The Regular Operations. | 1.1 | |
| **3** | Lec 7-9 | | | |
| **4** | Lec 10-12 | | | |
| **Class Test -1** | | | | |
| **5** | Lec 13-15 | Nondeterminism, Equivalence of NFAs and DFAs, Closure under the Regular Operations, Regular Expressions, Formal Definition of a Regular Expression, Nonregular Languages, The Pumping Lemma for Regular Languages. | 1.2, 1.3, 1.4 | |
| **6** | Lec 16-18 | | | |
| **7** | Lec 19-21 | | | |
| **Class Test – 2** | | | | |
| **8** | Lec 22-24 | Context-Free Languages, Context-Free Grammars, Formal Definition of CFG, Examples of CFG, Designing CFG, Ambiguity, Chomsky Normal Form. | 2.1 | |
| **9** | Lec 25-27 | | | |
| **10** | Lec 28-30 | | | |
| **Class Test - 3** | | | | |
| **11** | Lec 31-33 | Pushdown Automata, Formal Definition of a Pushdown Automaton, Examples of Pushdown Automata. | 2.2 | |
| **12** | Lec 34-36 | | | |
| **Class Test - 4** | | | | |
| **13** | Lec 37-39 | Turning Machines, Formal Definition of a Turing Machine, Examples of Turing Machines. | 3.1 | |
| **14** | Lec 40-42 | | | |

Date: 07 July, 2019

Lec. Zinia Sultana
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