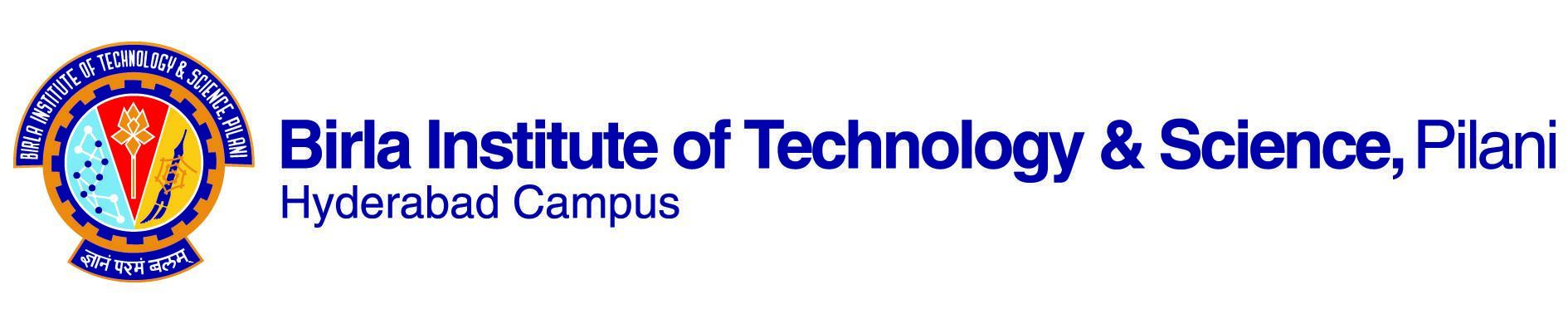
****

**FIRST SEMESTER 2023-2024**

# Course Handout Part II

**Date: 11.08.2023**

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : **CS F351**

## Course Title : **Theory of Computation**

## Instructor-in-Charge : **Dr.** **Raghunath Reddy M**

*Instructors* : **Prof. Gururaj**

**1. Scope and Objectives of the Course:**

The scope of this course includes- Languages; Finite automata and regular languages- Regular Expressions, Deterministic and Non-deterministic FA, Conversion from NDFA to DFA, Pumping theorem; Context free languages and CFGs- Push down automata, concepts in parsing, parse trees, Turing machines; Universal Turing Machines; Computability – decidability and semi-decidability, recursive languages, Church-Turing hypothesis; Undecidable problems – the halting problem.

The objectives of the course are

1. To provide a mathematical, i.e., proof-oriented foundation for the process of computations performed by computers.
2. To impart an understanding of the notions of automata, formal languages, grammars.
3. To understand the capabilities and limitations of computing machines.

**2. Textbooks:**

T1: J.E. Hopcroft and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa, 1979.

**3. Reference books:**

R1: Elements of the Theory of Computation, Harry Lewis and Christos Papadimitriou, Second Edition, PHI, Asia 1998.

R2: M Sipser, Introduction to the Theory of Computation, Thomson Asia, 1997.

R3: Jeffery Shallit, A second course in formal languages and automata theory, Cambridge University Press, 2008

R4: D. C. Kozen, Automata and Computability, Springer-Verlag, 1997.

R5: J.E. Hopcroft, R. Motwani and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson,3rd edition, 2001

**Online Study Material:**

NPTEL courses e.g. Theory of Computation, Formal Languages and Automata Theory

**4. Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-2 | To introduce the course theory of computation | Introduction to Languages and Operations Applicable to Languages. | T1 Chapter 1,  R1 Chapter 1 |
| 3-5 | To understand finite automata | Finite Automata: DFA and NFA | T1 Chapter 2,  R1 Chapter 2 |
| 6-9 | Regular Expression, NFA⬄RE⬄Regular Grammar, Closure Properties of Regular languages | T1 Chapter 2,  R1 Chapter 2 |
| 10-13 | Pumping Lemma, Myhill-Neorde Theorem, State Minimization | T1 Chapter 3,  R1 Chapter 2 |
| 14-16 | To understand push down automata | Context Free Grammar, Derivation Tree, Various Normal Forms of CFG | T1 Chapter 4,  R1 Chapter 3 |
| 17-19 | PDA, PDA⬄CFG, Context Free Languages | T1 Chapter 5,  R1 Chapter 3 |
| 20-23 | Properties of Context Free Languages; Pumping Lemma, Ogden’s Lemma, Closure Properties, Decision Properties | T1 Chapter 6,  R1 Chapter 3 |
| 24-25 | Deterministic CFL | T1 Chapter 10 |
| 26-29 | To understand Turing machine | Definition, Turing Computable Functions, Non-deterministic Turing Machine, Variants of TM, Recursive and Recursive Enumerable Languages, Universal TM | T1 Chapter 7,  R1 Chapter 4 |
| 30-34 | Undecidable Problems and Rice Theorem | T1 Chapter 8,  R1 Chapter 5 |
| 35-36 | Chomsky Hierarchy | T1 Chapter 9 |
| 37-40 | To understand time complexity classes | P, NP, NP-Completeness, co-NP | T1 Chapter 13,  R1 Chapter 6-7 |

**5. Evaluation Scheme:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| **Quiz-1** | 40 mins | 12.5% | To be announced  (before mid-sem) | Closed Book |
| **Quiz-2** | 40 mins | 12.5% | To be announced  (after mid-sem) | Closed Book |
| **Mid-Sem** | 90 mins | 30% | 09/10 - 4.00 - 5.30PM | Open Book |
| **Comprehensive Examination** | 180 mins | 45% | 07/12 AN | Closed Book |

**6. Mid-Semester grading:**  Minimum 40% weightage will be considered for the mid-semester grading.

**7. Chamber Consultation Hour:** to be announced in the class.

**8. Notices:** All notices about the course will be put on CMS.

**9. Make-up Policy:** Make-up will be granted only to genuine cases with prior permission from the IC.

**10. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**

**Raghunath Reddy M**