Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2021-2022

Course Handout Part II

Date: 20.08.2021

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	: **Mrityunjay Singh**
Instructors	: **Raghunath Reddy M, Ramisetty Kavya, S Vishwanath Reddy**

1. Scope 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.

2. Course Objectives:

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

2. Textbooks:

T1: Elements of Theory of Computation, Harry Lewis and Christos Papadimitriou, Second Edition, PHI, Asia 1998.

3. Reference books:

R1: J.E. Hopcroft and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa, 1979.
R2: Jeffery Shallit, A second course in formal languages and automata theory, Cambridge University Press, 2008
R3: D. C.Kozen,Automata and Computability,Springer-Verlag, 1997.
R4: J.E. Hopcroft, R. Motwani and J. D. Ullman, Introduction to Automata Theory, Languages and Computation,Pearson, 2001
R5: M.Sipser, Introduction to the Theory of Computation, Thomson Asia, 1997.

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	To introduce the subject theory of computation and various proof strategies	Introduction, Recap of proof strategies: induction, contradiction, pigeon hole principal, existence etc	T1 Chapter 1, R1 Chapter 1
2-3	To understand mathematical modeling of machines	Set, Letter, Alphabet, Language, Machine, Grammar	T1 Chapter 1, R1 Chapter 1
4-5	To understand finite automata	Finite Automata	T1 Chapter 2, R1 Chapter 2
6-8		DFA and NFA	T1 Chapter 2, R1 Chapter 2
9-11		Regular Expression, NFA⇔RE⇔Regular Grammar	T1 Chapter 2, R1 Chapter 2
12-13		Closure Properties of Regular languages	T1 Chapter 2, R1 Chapter 3
14-15		Pumping Lemma	T1 Chapter 2, R1 Chapter 3
16-17		Myhill-Neorde Theorem, State Minimization	T1 Chapter 2, R1 Chapter 3
18-20	To understand push down automata	Context Free Grammar, Derivation Tree, Various Normal Forms of CFG	T1 Chapter 3, R1 Chapter 4
21-23		PDA, PDA⇔CFG, Context Free Languages	T1 Chapter 3, R1 Chapter 5
23-28		Properties of Context Free Languages; Pumping Lemma, Ogden's Lemma, Closure Properties, Decision Properties	T1 Chapter 3, R1 Chapter 6
29		Deterministic CFL	R1 Chapter 10
30-32	To understand turing machine	Definition, Turing Computable Functions, Non-deterministic Turing Machine, Variants of TM,	T1 Chapter 4, R1 Chapter 7
33-35		Recursive and Recursive Enumerable Languages, Universal TM, Undecidable Problems, Rice Theorem	T1 Chapter 4-5, R1 Chapter 8
36-38		Chomsky Hierarchy	R1 Chapter 9
39-40	To understand time complexity class	P, NP, NP-Completeness, co-NP	T1 Chapter 6-7, R1 Chapter 13

5. Evaluation Scheme:

Sl No.	Component	Duration	Weightage (%)	Date & Time	Nature of Component
1	Mid Sem Test	90 minutes	30	20/10/2021 11.00 -12.30PM	Open Book
2	Quiz 1	30 minutes	10	Before mid sem	Open Book
3	Quiz 2	30 minutes	10	Before mid sem	Open Book
4	Quiz 3	30 minutes	10	After mid sem	Open Book
5	Comprehensive Exam	120 minutes	40	20/12 FN	Open Book

6.Consultation Hour: To be announced in the class

7. Notices: The notices for this course would be emailed to you or put in CMS.

8. Make-up Policy: Make-up (excepting Compre.) may be given for genuine cases with prior permission of IC, and after rigorous scrutiny. ***Request of makeup after the exam will not be entertained.*** For Comprehensive exam, make-up has to be approved and scheduled by AUGSD.

9. 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
CS F351