FIRST SEMESTER 2017-2018
Course Handout Part II

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

Course No. : **CS F351**
Course Title : **Theory of Computation**
Instructor-In-Charge : **VISHAL GUPTA (vishalgupta@pilani.bits-pilani.ac.in)**
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1. Course Description

Finite automata and regular languages, equivalence, closure properties, context free languages and push down automata – equivalence, closures properties, concepts in parsing; Turing machines; computability :decidability and semi-decidability, recursive and mu-recursive functions, Church-Turing hypothesis, undecidable problems – the halting problem, reductions between languages, complexity classes – P, NP, and NP-completeness

2. Objective

To provide a theoretical foundation for the process of computation and to impart an understanding of the notions of automata, formal languages, computability and complexity classes.

3. Scope

This course covers basic concepts of formal models of computation and computability. It introduces a hierarchy of machines and languages to capture classes of computable sets. It concludes with a generic notion of computability, and complexity classes of computable functions.

4. Textbook

1. Elements of Theory of Computation, Harry Lewis and Chistos Papadimitrou, Second Edition, Pearson Education, Asia 1998

5. Reference Books

1. Introduction to Automata Theory, Languages and Computation, John Hopcroft, Rajeev Motwani and Jeffrey Ullman, Second Edition, Pearson, Asia 2001
2. Introduction to Theory of Computation, Michael Sipser.

6. Lecture Modules

	Module	Learning Objective
1		To understand the basic concepts and notation

2	Finite automata and regular languages (6 lectures)	To understand finite automata as recognizers of languages and regular expressions as specifiers of languages. To understand the expressive power and limitations of finite automata and regular expressions
3	Context free languages and push down automata (10 lectures)	To understand context free grammars as specifiers and push down automata as recognizers of languages. To understand the expressive power and limitations of context free grammars and PDAs
4	Turing machines (7 lectures)	To understand Turing machines as recognizers of languages and theoretical models of general purpose computers
5	Computability and decidability	To understand the models of computable specifications and equivalences. To understand the notion of decidability
6	Complexity of classes (7 lectures)	To understand the classification of computable problems based on the notions of complexity of computation

Lecture Schedule

	Lec No	Topic	Reference(sections of textbook)
1	1	Introduction and motivation	1.1-1.3
	2	Infinite sets, proofs	1.4-1.5
	3	Closures	1.6
	4	Alphabets, languages, and representations	1.7-1.8
2	5	Deterministic finite automata	2.1
	6	Non-deterministic finite automata	2.2
	7,8	Closure properties and equivalences	2.3
	9	Regularity	2.4
	10	State Minimization	2.5
	11	Context free grammars	3.1
	12,13	Parse trees and ambiguity	3.2
	14	Push down automata	3.3
	15	Equivalence of PDA and CFG	3.4
	16,17	Properties of context free languages	3.5
	18	Determinism and parsing, DCFG	3.7
	19,20	top-down and bottom-up parsing	3.7
	21	Turing machines - introduction	4.1
	22	Turing machines - notation	4.1
	23	Recursive and recursively enumerable languages	4.2
	24,26	Random access Turing machines	4.3
	27	Non-deterministic Turing machines	4.5
	28	Grammars	4.6
	29	Primitive recursive functions	4.7

	30	Mu-recursive functions	4.7
	31	Church-Turing thesis and universal computing machines	5.1,5.2
	32	Halting problem	5.3
	33,34	Undecidable problems	5.7
	35	Properties of recursive languages	5.7
	36,37	The complexity class P	6.1,6.2
	38	Satisfiability	6.3
	39	The complexity class NP	6.4
	40	NP Completeness and Reducibility	7.1
	41	Cook's Theorem	7.2

9. Evaluation Scheme

Component	Mode	Duration	Date	Weightage
Quiz 1 [Regular Language]	Open Book	30 Mins	TBA	*10%
Quiz 2 [CFL]	Open Book	30 Mins	TBA	*10%
Quiz 3 [CFL]	Open Book	30 Mins	TBA	*10%
Quiz 4 [Turing Machine]	Open Book	30 Mins	TBA	*10%
Mid Semester test	Closed Book	90 Mins	13/10 9:00 - 10:30 AM	30%
Comprehensive Exam	Partially Open Book	180 Mins	11/12 FN	40%

12. Make UP Policy:

- *Out of 4 Quizzes, best 3 will be considered for final grading. No additional Make-up will be granted for any of the individual Quiz under any circumstances.
- Prior Permission of the Instructor-in-Charge is required to get make-up for the mid-term test. *Only on producing documentary proof of possible absence, which proves that student would be physically unable to appear for the test/exam, the decision of granting the make-up will be taken*.

Prior Permission of Dean, Instruction Division is required to get make-up for the comprehensive exam.

10. Notices and Announcements

Necessary notices, course announcements, uploading of marks of each component will be done on BITS-Nalanda. You are requested to check its website periodically. E Mail will be used as and when required.

11. Open Book Policy

The prescribed text book, reference books listed in the handout and hand written (student's own) class notes are the only materials that will be allowed.

Instructor In-Charge
CS F351