Birla Institute of Technology & Science, Pilani

K K Birla Goa campus

First Semester 2019-2020

CS F351 - Theory of Computation
Course Handout (Part-II)

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 Number	**:**	**CS F351**
Course Title	**:**	**Theory of Computation**
Instructors	**:**	**SOUMYADIP BANDYOPADHYAY (IC) and Bharat Deshpande**

- **Course Description:**

Finite Automata and Regular Languages – Equivalences, Closure Properties; Context Free Languages & Push-down automata – Equivalences, Closure Properties, Concepts in Parsing; Turing Machines; Computability & Decidability – Universal Turing Machine, Recursive Functions, Church-Turing Hypothesis; Complexity Classes – P, NP, Reducibility and NP-Completeness.

- **Objective**

To introduce the notions of automata, formal languages, computability, and complexity classes.

- **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 classes of complexity of computable functions.

- **Text Book**

Harry Lewis, Christos Papadimitriou.
Elements of the Theory of Computation.
Second Edition, Pearson Education, Asia. 1998

- **Reference Book**

Michael Sipser
Introduction to the Theory of Computation

- **Reference Book John C Martin**

  Introduction to Languages & The Theory Of Computation. Third Edition. Tata McGraw Hill Education Private Limited

- **Course Plan**

- **Lecture Modules:**

Number	Module	Learning Objective
1	**Introduction (4 lectures)**	To understand basic concepts and notation to be used.
2	**Finite Automata & 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 & 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 Gramars and PDAs.
4.	**Turing machines (7 lectures)**	To understand Turing machines as recognizers of languages and as theoretical models of general purpose computers.
5.	**Computability & Decidability (8 lectures)**	To understand 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 notions of complexity of computation.

- **Lecture Schedule:**

Module Number	**Lecture Number**	**Topic**	**Reference (Sections of the text book)**
1	1	Introduction & Motivation	1.1-1.3
	2	Inifinite Sets, Proofs	1.4-1.5
	3	Closures	1.6
	4	Alphabets, Languages & Representation	1.7-1.8
2	5	Deterministic Finite Automata	2.1
	6	Non-Deterministic Finite Automata	2.2
	7 & 8	Closure Properties & Equivalences	2.3
	9	Regularity	2.4
	10	State Minimization	2.5
3	11	Context Free Grammars	3.1
	12 & 13	Parse Trees & 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 & Parsing. DCFG.	3.7
	19 & 20	Top-down & Bottom-up Parsing	3.7

4	21	Turing Machines – Introduction	4.1
	22	Turing Machines - Notation	4.1
	23	Recursive and Recursively enumerable languages	4.2
	24	Extensions of Turing machines	4.3
	25 & 26	Random Access Turing machines	4.4
	27	Non-deterministic Turing machines	4.5
5	28	Grammars	4.6
	29	Primitive Recursive Functions	4.7
	30	Mu-recursive functions	4.7
	31	Church-Turing Thesis & Universal Turing machines	5.1 & 5.2
	32	Halting problem	5.3
	33 & 34	Undecidable problems	5.4,5.5
	35	Properties of Recursive languages	5.7
6	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
	42	NP Complete Problems	7.3

- **Evaluation Scheme**

Component	**Mode**	**Duration**	**Date**	**Weightage**
Mid Term Test	Closed Book	See Time Table	See Time Table	**30%**
Quiz	Open Book	To be announced	Surprise component/Announced	**30%**
Comprehensive	Closed Book	See Time Table	In December	**40%**

- **Seven** quizzes will be conducted. Each Quiz carries 6**%** weightage and **best five** would be considered.

NO MAKE-UP REQUESTS WILL BE ENTERTAINED FOR ANY QUIZ

NO MAKE-UP REQUESTS WILL BE ENTERTAINED FOR ANY Coding Test

- **Make-up Policy:** Make-up for Tests will be granted strictly on prior permission and on justifiable grounds only.

- **Notice:** All notices for this course will be posted on Moodle page.

IC - CS F351

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