Course Outline

Course Objective and Outcome Form

Department of Electrical and Computer Engineering
School of Engineering and Physical Sciences
North South University, Bashundhara, Dhaka-1229, Bangladesh

1. **Course Number and Title**
   CSE 273/473 Theory of Computation

2. **Number of Credits**
   3 Credits (Theory)

3. **Type**
   Core (for old curriculum) / elective (for new/130 Cr. Curriculum)

4. **Prerequisites**
   CSE 225 - Data Structure and Algorithms

5. **Contact Hours**
   Lecture 3 hours per week (Total 36 hours)

6. **Instructor:** Md Salman Shamil (SMSL)
   Office: SAC 1143. Email: salman.shamil@northsouth.edu

   Office Hours: ST: 11:10 AM – 12:10 PM; MW: 09:40 AM – 12:10 PM.

7. **Course Summary**
   Alphabets, String Operations, Formal Languages and key operations upon them, Regular Expressions, Deterministic/Non-Deterministic Finite Automata, Context-Free Grammars and Languages (CFG and CFL), Chomsky Normal Form, Parse Trees, Pushdown Automata, Turing Machines (TM), Universal Turing Machines, Unrestricted Grammars, Context Sensitive Grammars and Languages, Chomsky Hierarchy, Computability, Decidability, Church-Turing Thesis, Halting Problem.

8. **Course Objectives**

   a. to analyze and design finite automata, pushdown automata, Turing machines, formal languages, and their corresponding grammars.

   b. to understand the key notions of the theory of computation, such as regular expressions, context free grammars, Turing Machines, computability, decidability, Chomsky hierarchy.

   c. to prove the basic results of the Theory of Computation such as pumping lemma.

9. **Course Outcomes (COs)**

CO	Course Outcome Description	Weightage (%)
CO1	Build RE and automata such as DFA, NFA and ϵ-NFA that can be used to recognize a given regular language.	50
CO2	Design context free grammar and corresponding PDA for a given language.	30
CO3	Design and analyze Turing Machines for a given language.	20

10. Mapping of CO-PO

CO	Mapped POs	KP	Bloom's Level	Delivery Methods	Assessment Tools
CO1	PO2	K2,K4	Cognitive / Apply	Lectures, Notes	Quiz / Exam / Assignment
CO2	PO3	K2,K5	Cognitive / Apply	Lectures, Notes	Quiz / Exam / Assignment
CO3	PO3	K4,K5	Cognitive / Apply	Lectures, Notes	Quiz / Exam / Assignment

11. Resources

Textbooks

1. Hopcroft, J. E., Motwani, R., & Ullman, J. D. (2008). Introduction to automata theory, languages, and computation (3rd ed.). Pearson.

Reference Books

1. Sipser, M. (2013). Introduction to the theory of computation (3rd ed.). Cengage Learning.

12. Weekly Course Schedule (Theory)

(12 Weeks = 36 Contact Hours)

Week	Theory Topics
1	Course overview; Introductory concepts for automata theory
2	Deterministic Finite Automata (DFA): Design and Analysis
3	Non-deterministic Finite Automata (NFA): Design and Analysis; Equivalence of DFA and NFA
4	Epsilon-transitions in NFA; Regular Expressions
5	Pumping Lemma for Regular Languages
6	Closure Properties and Decision Properties of Regular Languages; Equivalence and Minimization of DFAs
7	Context Free Grammars and Languages
8	Pushdown Automata
9	Equivalence of PDAs and CFGs; Chomsky Normal Form
10	Turing Machine
11	Decidability: Halting Problem. Undecidability; Church–Turing Thesis and Universal Turing Machine
12	P vs NP, Reductions and NP-completeness

13. Weightage Distribution among Assessment Tools

Assessment Tools	Weightage (%)
Attendance	5
Assignments	5
Class Performance	10
Quizzes	20
Midterm	30
Final Exam	30

14. Grading Policy

As per NSU grading policy available at: www.northsouth.edu/academic/grading-policy.html

15. Online Resources

- Lecture slides and materials:
  https://eecs.wsu.edu/ ananth/CptS317/Lectures/index.htm
- Supplemental video resources:
  https://web.cecs.pdx.edu/ harry/videos/
- Video playlist on YouTube:
  https://youtube.com/playlist?list=PLbtzT1TYeoMjNOGEiaRmm_vMIwUAidnQz