COURSE PLAN **Spring 2021-2022** SEMESTER

I. Course Core and Title

CSC 3113: Theory of Computation

II. Credit

3 credit hours (3 hours of theory per week)

III. Nature

Core Course for CS, CSE, CSSE, CIS

IV. Prerequisite

CSC 2105: Data Structure

V. Vision:
Our vision is to be the preeminent Department of Computer Science through creating recognized professionals who will provide innovative solutions by leveraging contemporary research methods and development techniques of computing that is in line with the national and global context.

VI. Mission:
The mission of the Department of Computer Science of AIUB is to educate students in a student-centric dynamic learning environment; to provide advanced facilities for conducting innovative research and development to meet the challenges of the modern era of computing, and to motivate them towards a life-long learning process.

VII - Course Description:

- Basic notations used in computer science literature
- Understand the mathematical model of Computation.
- Use of Computational models to solve problems
- Understand Computability
- Determine Complexity of problems

VIII – Course outcomes (CO) Matrix:

By the end of this course, students should be able to:

COs *	CO Description	Level of Domain**				PO Assessed***
		C	P	A	S	
CO1	Apply the principles of existing computational models to find out an appropriate solution for a complex problem.	3				PO-a-3
CO2	Compute the decidability and the solvability of a complex problem based on the stablished methods using computational model.	3				PO-a-3

C: Cognitive; P: Psychomotor; A: Affective; S: Soft-skills (CT: Critical Thinking, TS: Teamwork)
* *CO assessment method and rubric of COs assessment is provided in Appendix section*
** *The numbers under the 'Level of Domain' columns represent the level of Bloom's Taxonomy each CO corresponds to.*
*** *The numbers under the 'PO Assessed' column represent the PO (appendix) each CO corresponds.*

IX – Topics to be covered in Theory class*:

TOPICS	Specific Objective(s)	Time Frame	Teaching Activities	Assessment Strategy(s)	CO mapped
Mission & Vision of AIUB, Basic Mathematical Concepts	To make students understand about the Mission & Vision of the university, Course objective, Outcome, Outline, Class & Course Policies, Exam & Evaluation Policies. Introduction to Theory of Computation.	Week 1 Lecture 1	Discussion on Mission & Vision of AIUB, Introduction to Theory of Computation Review of Pre-requisite study materials.	Lecture, Group Discussion	
Finite Automaton, Deterministic Finite Automaton (DFA)	Basic Model of Computation, Formal Definition of a finite automaton, DFA, Designing DFA	Week 1 Lecture 2	Discussion, Group study and perform of exercises.	Lecture, Group study Homework Quiz	
DFA	Designing DFA continued, Regular Language, Closure under regular operation	Week 2 Lecture 1	Discussion, Group study and perform of exercises.	Lecture, Group study Homework	
Non-determinism and Non-regular languages	Understanding NFA, Designing NFA, Equivalence of NFAs and DFAs	Week 2 Lecture 2	Discussion, Group study and perform of exercises	Quiz	CO1
Closure	Designing NFA continued, Closure under the regular operations	Week 3 Lecture 1	Discussion, Group study and perform of exercises	Lecture, Group study Homework	
Regular Expression	Understanding RE, Designing RE, Equivalence with FA, Conversion of RE to NFA, DFA to RE	Week 3 Lecture 2	Discussion, Group study and perform of exercises	Quiz	CO1
Regular Expression	Conversion of DFA to RE continued, Closure, Non-regular Language, Pumping Lemma	Week 4 Lecture 1	Discussion, Group study and perform of exercises	Quiz	CO2
Context free Languages	Learning powerful representation of Languages. Designing context-free grammars.	Week 4 Lecture 2	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework Quiz	

Context Free Grammar (CFG)	Designing context-free grammars continued	Week 5 Lecture 1	Discussion, Group study and perform of exercises	Quiz	CO1
Ambiguous Grammar, Chomsky Normal Form	Understanding ambiguity and Chomsky normal form of CFG	Week 5 Lecture 2	Discussion, Group study and perform of exercises	Quiz	CO2
Push Down Automata	Understanding PDA, equivalence with context-free grammars.	Week 6 Lecture 1	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework	
REVIEW Assignment Submission + Viva		Week 6 Lecture 2	Submission, Discussion	Viva	
Midterm Week Week 7					
Turing Machine	Understanding Computability and Formal Definition TM, State Diagram Representation, terminology, acceptable	Week 8 Lecture 1	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework	
Turing Machine	Designing TM, Multi tape TM, k-tape TM, Nondeterministic TM,	Week 8 Lecture 2	Discussion, Group study and perform of exercises	Quiz	CO1
Turing Machine	Designing TM continued, Algorithms	Week 9 Lecture 1	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework	
Turing Machine	Empty ness Testing, DFA-Equivalence, Deciding Languages, Universal TM	Week 9 Lecture 2	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework Quiz	
Turing Machine	Halting Problem, Countable, Uncountable problem	Week 10 Lecture 1	Discussion, Group study and perform of exercises	Quiz	CO2
Decidability and Undecidability	Getting the concept of Decidable language, Church-Turing thesis	Week 10 Lecture 2	Discussion, Group study and perform of exercises	Quiz	CO2

Decidability and Undecidability	Church-Turing thesis continued	Week 11 Lecture 1	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework	
Theory of NP completeness	Getting the idea of complexity of problems, NP completeness of some problems, Cook-Levin theorem	Week 11 Lecture 2	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework Quiz	
NP Completeness	NP completeness continued,	Week 12 Lecture 1	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework	
Time/Space complexity	Understanding PSPACE and Savitch's theorem	Week 12 Lecture 2	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework Quiz	
Time/Space complexity	Understanding PSPACE and Savitch's theorem continued	Week 13 Lecture 1	Discussion, Group study and perform of exercises	Lecture PPT Slides Board Work Homework	
Review Assignment Submission + Viva		Week 13 Lecture 2	Submission, Discussion	Viva	
Final term Week Week 14					

* The faculty reserves the right to change, amend, add or delete any of the contents.

XI- Course Requirements

1. Attending at least 80% of the class.
2. Submission of assignment and projects in due time

XII – Evaluation & Grading System

The following grading system will be strictly followed in this class

Evaluation				
Attendance		10		Final Grade
Quiz/Viva	3 x 10	30		Mid Semester Assessment: 40%
Assignment/Viva	10+10	20		Final Term Assessment: 60%
Term Assessment				
Exam		40		Grand Total: 100%
Total		100		

Grand Total - - - - - - - -40% of Midterm + 60% of Final Term

The evaluation system will be strictly followed as par the AIUB grading policy.

Numerical %	Letter	Grade Point
90-100	A+	4.00
85 - < 90	A	3.75
80 - < 85	B+	3.50
75 - < 80	B	3.25
70 - < 75	C+	3.00
65 - < 70	C	2.75
60 - < 65	D+	2.50
50 - < 60	D	2.25
< 50	F	0.00

XV – Textbook/ References

- Introduction to the Theory of Computation (Latest Edition)
  by Michael Sipser
- Introduction to Automata Theory, Languages, and Computation (Latest Edition)
  by John E. Hopcroft, et al
- Elements of the Theory of Computation (Latest Edition)
  by Harry R. Lewis, Christos H. Papadimitriou