INSTITUTION FAST - National University of Computers and Emerging Sciences

BS - Computer Science

PROGRAM (S) TO BE EVALUATED

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Title	Theory of Computation / Automata		
Course Code	CS301	**Credit Hours**	3 + 0
Prerequisites by Course(s)	Discrete Structures	**Semester**	Spring 2021
Assessment Instruments (with tentative weights)	**Semester Work 20%** (at least 5 assignments) **Midterm 30%** (2 Mid semester exam – Week 6 and Week 12) **Final 50%** (Comprehensive end of semester exam)		
Course Instructor	M. Shahzad | Mrs. Shaharbano | Mrs. Bakhtawer | Musawar		
Office Hours	Details displayed outside my Basement (Old library- CS Block).		
Discussion Group			
Reference Book(s) Please keep a personal copy of either Ullman or Cohen	1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation 2. P. Linz. Introduction to Formal Languages and Automata, 6th edition, 2017 (or 5th or 4th edition), Jones and Barlett 3. Daniel I. A. Cohen, Introduction to Computer Theory 4. John Martin, Introduction to Languages and the Theory of Computation, Third Edition 5. Michael Sipser, Introduction to Theory of Computation		
Course Goals	1. Provide mathematical maturity in the field of computer science. 2. Develop skills of precise and formal reasoning. 3. Describe the role of abstract computational models to define which computational problems are solvable and which are not. 4. Define formal languages and their description in the form of formal grammars. 5. Design grammars and models for different languages. 6. Differentiate between deterministic and non-deterministic models and their limitations.		

Topics Covered in the Course (Tentative plan)

Please note:

1. Students are expected to go through the suggested reading topics from at least one reference book and internet, before & after each class.
2. Representative topic of suggested chapters are given week-wise (on right) as **Chapter [Ullman] / [Cohen]**. Please read the full chapter(s).
3. Apart from graded assignments, students are expected to discuss and solve exercises at the end of each chapter.

Week #	Lecture #	Topics	Chapters
1.	**1.**	Discussion on Course Outline, Introduction to Finite Automata	[HMU]:1.1 [Linz]: 1
	2.	What does automata means? Introduction to Languages, Alphabets, Strings	[HMU]: 1.5 [DC]: 1
	3.	Kleene Star Closure, Regular Expression (RE)	[DC]: 4 [HMU]: 3 [JM]: 3 [Linz]: 3
2.	**1.**	Equivalent RE, Finite Automaton (FAs), Equivalent FAs	[HMU]: 2 [JM]: 2 [MS]: 1
	2.	FA corresponding to finite languages, Transition Graph	[Linz]: 2.1 [DC]: 6
	3.	Continued	
3.	**1.**	Examples of TGs: accepting all strings, accepting none, starting with b, not ending in b, containing aa, containing aa or bb.	[Linz]: 2 [DC]: 6
	2.	Generalized Transition Graph	[DC]: 6
	3.	Language accepted by NFA, Recursive definition of NFA	[Linz]: 2.2 [HMU]:2.3
4.	**1.**	Basis Clause and Inductive Clause of NFA	[Instructor Notes]
	2.	NFA with Λ Transitions, Language accepted by NFA- Λ, Definition of Λ-Closure, Basis Clause and Inductive Clause of NFA- Λ	[Instructor Notes]
	3.	Conversion of NFA- Λ to equivalent NFA	[Instructor Notes]
5.	**1.**	Conversion of NFA to equivalent DFA	[Instructor Notes]
	2.	Equivalence of DFAs, NFAs and NFA- Λ	[Instructor Notes]
	3.	Kleene's Theorem Part-1 & Part-2	[JM]: 3.4, 3.5 [DC]: 7
6.	**1.**		
	2.	**Mid-I Examination**	
	3.		
7.	**1.**	Complement of Regular Language and Complement of DFA, Intersection of Regular Languages	[Instructor Notes]
	2.	Properties of RLs	[Linz]: 4 [HMU]: 4

	3.	Pumping Lemma	[HMU]: 4.1 [JM]: 2.4
8.	**1.**	Minimization of DFA	[Instructor Notes] [HMU]: 4.4
	2.	Mealy & Moore Machines	[DC]: 9
	3.	Conversion between Mealy & Moore Machines	[Instructor Notes]
9.	**1.**	Regular Grammars, Linear Grammar, Context-free Languages (CFL), Context-free grammars (CFG).	[DC]: 13 [MS]: 2
	2.	Parse Trees, Derivations and ambiguity and Chomsky-normal-form grammars (CNF), Null Production	[DC]: 20 [Linz]: 6.2
	3.	Trees, Polish Notations, Total Language Tree	[JM]: 4.4
10.	**1.**	Push down automata (PDA)	[JM]: 5 [DC]: 17 [MS]: 2.2
	2.	Deterministic PDA	
	3.	NPDA and CFG Equivalence	
11.	**1.**		
	2.	**Mid-II Examination**	
	3.		
12.	**1.**	Turing Machines (TM) Intro & Formalities	[MS]: 3.1 [Linz]: 9
	2.	Designing TM as Acceptors/Transducers	[Linz]: 9
	3.	Turing's Thesis, Turing Machine Variations	[MS]: 3.2 [DC]: 27
13.	**1.**	Universal Turing Machine Decidability	[JM]: 7.8 [DC]: 27
	2.	Recursive vs. recursively enumerable	[JM]: 8 [DC]: 28
	3.	Continued	
14.	**1.**	Decidable Problem and Undecidable Problem,	[JM]: 9 [HMU]: 9 [MS]: 4
	2.	Continued	
	3.	The Chomsky Hierarchy	[JM]: 8.3
15.	**1.**	Revision	
	2.		
	3.		

	16.	**1.**	**Final Exam**	

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	15	15	3

Oral and Written Communications	Every student is required to submit at least ___5__ written assignments of typically __3-4_ pages at least and to make no oral presentations.
Academic Integrity Zero tolerance on cheating as per FAST Policies. All Cases (in any Assessment Instruments) will be referred to department committee.	Plagiarism is strictly prohibited and would be strictly dealt with. Late submission of assignment will be allowed until its solution is discussed. It is better to partially attempt what you understand and submit remaining as late, than to copy from someone else or internet. - Max Grade penalty of 50% (in assignment) for late submit. - Min Grade penalty of 100% (in course) for plagiarism. **When taking help in your assignments (from web)** - Cite reference clearly, mentioning URL and content taken. - Even if referred, it is still plagiarism to use the same sentence or change it in active/passive form. Use your own words, ALWAYS!. **When taking help in your assignments (from peers)** - Discussing assignments with peers is allowed only on discussion group. Do not provide excuses later. - Provide help in form of explaining problem rather than explaining solution. Group discussion is encouraged.
Evaluation Policy For FAST Policies please read the student handbook.	- Attendance and Quizzes will be held in start of class. - Exams may be open book (closed notes). Please do NOT write or mark anything on the book. - There will be NO compensation for missed quiz. - All graded evaluations will be property of the instructor. - Take classes only with your section, assigned by FAST CS dept. **- <u>IMPORTANT</u>**: Always send me same day EMAIL reminder if I give you any verbal comment e.g class participation bonus, late submission allowed, leave allowed, average marks etc.