Bangabandhu Sheikh Mujibur Rahman Science & Technology University, Gopalganj.
Department of Computer Science and Engineering
2nd Year 2nd Semester B. Sc. Engineering Examination-2013
Course No. : CSE260, **Course Title:** Automata Theory

Full Marks: 70 **Time:** 3 hours

N.B.: Instruction for Candidates:
i) The figures in the right margin indicate full marks.
ii) Answer any **SIX** questions, taking any **THREE** from each section.
iii) Use separate answer script for each section.

Section - A

1.	a)	What is automata theory? Why we study automata theory?	3
	b)	What is transition function? Discuss different types of transition function.	3
	c)	What do you mean by deterministic finite automat?	2.67
	d)	Draw the NFA for the following regular expression. $R = (ab\hat{}a) * a * cd * b$	3
2.	a)	How can you eliminate $\epsilon -$ transitions?	3
	b)	Define regular expression. Explain the rules of regular expression.	5.67
	c)	Give English descriptions of the following languages of the following regular expressions: i) $(1 + \epsilon)(00^*1)^*0^*$ ii) $(0^*1^*)^*000(0 + 1)^*$	3
3.	a)	Prove that every languages defined by a regular expression is also defined by a finite automata.	5
	b)	Convert the regular expression (0+1)*1(0+1) to $\epsilon -$ NFA.	5
	c)	Define a phrase structure grammar.	1.67
4.	a)	Discuss different types of phrase structure grammar.	5.67
	b)	How can you write context free grammar? Explain with example.	6

Section - B

5. a) How can you convert an NFA to a DFA? Briefly explain. 6

   b) Construct DFAs for each of the following regular languages. In all cases the alphabet is {a,b}. 5.67

      i) The set of strings that has exactly 3 bs (any number of as).

      ii) The set of strings where the number of bs is a multiple of 3 (and there can be any number of as).

      iii) The set of strings where the difference between the number of as and the number of bs is a multiple of 3.

6. a) Explain the closure properties of regular languages. 5.67

   b) Convert the following NFA to a regular expression using state elimination technique 6

	0	1
→A	{A}	{A,B}
B	{C}	{C}
*C	{D}	{D}
*D	**Φ**	**Φ**

7. a) The following grammar generates the languages of regular expression: 6

   (x+y)*x-z*y/(x+x)

   Derive leftmost and rightmost derivations of this regular expression.

   $S \to x, S \to y, S \to z, S \to S + S, S \to S - S, S \to S * S, S \to S/S \text{ and } S \to (S)$

   b) Define parse tree. How can you construct parse trees? 5.67

8. a) Describe Turing machine. 3

   b) What is the final tape when the Turing machine T defined by the seven five tuples: (S0, 1, S0, 0, R), (S0, 1, S1, R), (s0, B, S3, B, R), (S1, 0, S0, 0,R), (S1, 1, S2, 0, L), (S1, B, S3, B, R) and (S2, 1, S3, 0, R) is run on the tape shown in the following figure- 5

			S0								
.....	B	B	0	1	0	1	1	0	B	B	.....

   c) Find a Turing Machine that recognizes the set of bit strings that have a 1 as their second bit that is the regular set (0+1)1(0+1) 3.67