

Unique Paper Code : 32341502
 Name of Course : B.Sc. Hons. Computer Science
 Name of the Paper : Theory of Computation
 Semester : V
 Duration of Examination : 3 Hours
 Maximum Marks : 75 Marks
 Students admitted in the year : 2015, 2016, 2017, 2018

Instructions for Candidates:

1. Answer any **FOUR** questions.
2. All questions carry equal marks.
3. Assume $\Sigma = \{a, b\}$ for all the questions unless specified otherwise.

1.	Construct a regular expression and corresponding deterministic finite automaton (DFA) defining a language comprising all strings of length 5 or more such that the letter appearing just before the last is same as the second letter of the string.
2.	Construct a finite automaton (FA) for $FA_1 + FA_2$, $FA_1.FA_2$, and FA_1^* . <div style="text-align: center; margin-top: 10px;"> </div>
3.	For languages, $L_1: (aa + ab + ba + bb)^*$ and $L_2: (a + b)^*aa(a + b)^*$, construct respective DFA's and derive a finite automaton that defines $L_1 \cap L_2$. Also, construct a regular expression for the resultant DFA.
4.	Prove that the language $L = \{a^n b^{2m} a^{2m} b^n : n \geq 1\}$ is non-regular and construct a Pushdown Automaton (PDA) that accepts L . Trace the working of PDA on the string aabbbbbaaaabb .

5.	<p>Consider the following context free grammar (CFG):</p> $S \rightarrow 0 A 0 \mid 1 B 1 \mid B B$ $A \rightarrow C$ $B \rightarrow S \mid A$ $C \rightarrow S \mid \epsilon$ <p>Eliminate ϵ – productions, followed by the elimination of unit productions, and then remove all the useless symbols. Also, put the resultant grammar into Chomsky Normal Form (CNF). Here, ϵ represents the null string.</p>
6.	<p>Considering $\Sigma = \{a, b, \triangleright, \sqcup\}$, design a Turing Machine (TM) (single tape or multi-tape as you prefer) that transforms $\sqcup w \sqcup$ to $\sqcup w w \sqcup$. Show the trace of TM on the string $\sqcup abb \sqcup$.</p>