Unique Paper Code	:	32341502-OC
Name of the Course	:	B.Sc. Honours (CBCS)
Name of the Paper	:	Theory of Computation
Semester	:	V
Year of Admission	:	2015, 2016, 2017, 2018

Duration: 3 Hours Maximum Marks: 75

Instruction for candidates

1. All questions carry equal marks.
2. Assume $\Sigma = \{a, b\}$ as the underlying alphabet set unless mentioned otherwise.

Attempt any Four Questions out of six Questions.

1.	Build a deterministic finite automaton (DFA) that accepts the language **L**, where **$L = \{ a^i b^j \mid (i+j)$ is not divisible by 2$\}$.** Also convert the above DFA into regular expression using bypass algorithm.
2.	For languages L_1 and L_2 described by the corresponding regular expressions $(a + b)^* a$ and $(a + b)^* b$, construct the following a) DFA for **L1** and **L2** and b) finite automata that define $L_1 \cap L_2$. Trace the word "**aabb**" on the constructed finite automata..
3.	Let $\Sigma = \{a\}$ and $L = \{a^p \mid p$ **is a prime**$\}$. Are the languages **L**, **L*** (kleene closure of L), and L' (complement of L) regular? Justify your answers. Wherever possible, construct the corresponding DFA.
4.	Let $\Sigma = \{a, b, c\}$ and let **L** be a language defined as $L = \{a^n b^{n+m} c^m \mid n,m >= 1\}$. Construct a CFG that generates the language **L**. Also construct a pushdown automata (PDA) for the language **L**.
5.	Consider the following grammar: S -> 0A0 | 1B1 | BB A -> C B -> S | A C -> S | Λ Eliminate Λ-productions (null productions) followed by the elimination of unit productions in the resulting grammar. Finally after removing any useless symbols, convert the grammar into Chomsky Normal Form.

6.	Design a 2-tape Turing Machine (TM) that computes the bitwise AND of two input sequences. The first tape contains $\sqcup w_1 \# w_2 \sqcup$, where w_1, w_2 are bitwise input sequences and '#' is a separator between input sequences. Trace the computation of TM when content of the first tape is $\sqcup 101\#110 \sqcup$ and second tape is empty.