(Please write your Exam Roll No.) Exam Roll No. .....

END TERM EXAMINATION

FIFTH SEMESTER [B.TECH./M.TECH.]- DECEMBER 2010

Paper Code: IT301 **Subject: Theory of Computation**
Paper ID: 15301

Time : 3 Hours **Maximum Marks : 60**

Note: Attempt all questions. Internal choice is indicated.

Q1 Attempt **any three** parts of the following:-

(a) Define deterministic and nondeterministic finite automata mathematically. Consider the following DFA over the alphabet $\sum = \{0,1\}$. Construct a minimal equivalent DFA. **(4)**

	0	1
A (start)	B	A
B	C	D
C (final)	F	E
D	E	A
E	F	D
F (final)	F	B

(b) Define Pumping Lemma for regular languages and show the language $L = \{a^n b^n | n >= 1\}$ is Nonregular. **(4)**

(c) Draw a Deterministic Finite Automaton to accept the following regular expression and succinctly describe the set in English $[00+11+(01+10)(00+11)^*(01+10)]^*$ **(4)**

(d) Define pushdown automata mathematically. Construct a PDA A accepting $L = \{wcw^T | we\{a,b\}^*\}$ by final state. **(4)**

Q2 Attempts **any three** parts of the following:-

(a) Consider the following grammar G:

$S \rightarrow 0A0|1B1|BB$

$A \rightarrow C$

$B \rightarrow S|A$

$C \rightarrow S|\varepsilon$

Simplify the above grammar. What is L(G)? What is correct order of the steps: (1) eliminate useless symbols (2) eliminate ε-productions (3) eliminate unit productions, in simplification of a context free grammar in general? **(4)**

(b) Let M1 and M2 be the two Finite automata's accepting the language L1 and L2 respectively. Design an automata recognize the language (i) $L1 \cap L2$ (ii) $L1 - L2$. Where L1=(No. of a's in the string defined over a, b is even) and L2={no. of b's in the string defined over a,b is odd}. **(4)**

(c) Show that two CFL's L1 and L2 are closed under Union but they are not closed under intersection. **(4)**

(d) Design a Turing machine to delete a symbol under the R/w head. **(4)**

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Q3 Attempt **any two** parts of the following:-

(a) What is Parsing? Consider the following grammar $S \rightarrow 0S0|1S1|10$. Construct the SLR Parsing Table for this grammar and show all moves for the parsing of input string 0100 using this table. **(6)**

(b) Define Pumping Lemma for Context Free Languages. **(6)**

(c) Consider the language: $L = \{(k,w) | \textit{Turing machine } T_k \textit{ will halt on input } w.\}$. Prove that L is Undecidable. **(6)**

Q4 Attempt **any two** parts of the following:-

(a) Prove that NSPACE(f(N)) is equivalent to SPACE(f^2(N)). **(6)**

(b) Prove that Multi-tape Turing machine is computationally equivalent to standard Turing Machine. Consider L as recursive enumerable and complement of L is also recursive enumerable then show that L is a recursive language. **(6)**

(c) Write short comments on the following:-
(i) L and NL (ii) PSPACE AND NPSPACE (iii) Churche-Turing thesis **(6)**

Q5 Attempt **any one** part of the following:-

(a) Prove that CNF satisfiability is NP-complete. **(12)**

(b) Prove that True quantifier Boolean formula satisfiability is PSPACE complete. **(12)**

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