Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (COMPUTER SCIENCE AND ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: FORMAL LANGUAGES AND AUTOMATA THEORY

[CSE 2201]

REVISED CREDIT SYSTEM

(19/ 04 /2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A A binary tree is a tree in which no parent can have more than two children. Prove that a binary tree of height n has at most 2^n leaves using proof by induction 2M

1B Define Grammar. If $L_1 = \{a^{n+2}b^n : n \geq 1\}$ and $L_2 = \{a^n b^{n-3} : n \geq 3\}$ on $\sum=\{a,b\}$, generate the grammar for $L_1 U L_2$. 3M

1C Construct an Nondeterministic Finite Accepter (NFA) with three states that accepts the language $\{ab, abc\}^*$. Convert the resultant NFA into DFA and minimize number of states using mark and reduce procedure 5M

2A Using Generalized Transition Graph (GTG), find a regular expression for the language $L = \{w \in \{a, b\}^* : n_a(w)$ is even and $n_b(w)$ is odd$\}$. 5M

2B Using Pumping Lemma, Show that the $L = \{ 0^n : n$ is a perfect square$\}$ on $\sum = \{0\}$ is not regular. 3M

2C For $\sum = \{ a,b\}$, $\Gamma = \{ a,b,c\}$, h(a) = ab , h(b) = bbc, find h(aba). If L = {aa, aba}, what is h(L)? 2M

3A Write the context free grammar for

(i) $L= \{a^n b^n c^i : n \geq 1, i \geq 0\}$

(ii) $L= \{ab^n cd^n f : n \geq 0\}$ (1+1)M

3B Define S-grammar. Write the S-grammar for $L= \{ a^n b^{n+1} : n \geq 2\}$ 3M

3C Eliminate λ, unit and useless productions from the following and convert it into CNF.
S→aA | aB
A→aaA | λ
B→bB | bbC
C→B
What is the language generated by this grammar? 5M

4A With a neat transition diagram, construct an NPDA for accepting the L= { ww^R : w ∈ {a, b}$^+$ } and show the rejection of the string "abaabb". 3M

4B Define Deterministic Pushdown Automata. Design a deterministic pushdown automaton for the language L = {0^n1^n : n ≥ 0}. Draw the transition graph for the same. Also write the ID for accepting the string "0011". 4M

4C With a neat transition diagram, design a Turing machine that accepts the language L = {w : |w| is odd}. Write the ID for accepting the string "abbab" 3M

5A Given 2 positive integers x and y represented in unary, design a Turing Machine that computes x+y. Write the ID for "110111" 4M

5B Explain the following models of Turing Machine with neat diagram for each.
i) Offline Turing Machine
ii) Universal Turing Machine. (2+2)M

5C Define Unrestricted grammar and Post correspondence problem. 2M

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