BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : V**
BRANCH: CSE **SESSION : MO/18**

SUBJECT: CS5101-FORMAL LANGUAGES AND AUTOMATA THEORY

TIME: 03:00 **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What is Abstract machine? Answer in only one sentence. [2]
(b) Is DFA an Abstract Machine? If yes, then describe its structure. [4]
(c) Design a DFA to recognize strings over Σ = {0,1} such that its last 3 places contain exactly one '0'. [6]

Q.2(a) What do you mean by Regular Expression? [2]
(b) Prove the identity: [4]
εR = Rε = R
(c) Write R.E. for string containing even number of 0's over Σ = {0,1}. From this R.E. derive the corresponding DFA. [6]

Q.3(a) How Mealy and Moore machines are different? [2]
(b) Mealy and Moore machine are equivalent to each other. Justify [4]
(c) Design a Mealy machine that read a string of {0,1} and produce string of {a.b}. It will produce an 'a' for a '0' in input and a 'b' for a '1' in input. Convert this Mealy machine to corresponding Moore machine. [6]

Q.4(a) Differentiate between context free languages and context sensitive languages. [2]
(b) Write down grammar for the language **$L=\{ uww^ru^r \mid u \varepsilon (c, d)^* \text{ and } w \varepsilon (a, b)^* \}$** [4]
(c) Remove all unit-productions, all useless productions, and all ε -productions from the grammar [6]
S-→aA|aBB
A-→aaA| ε
B-→bB | bbC
C-→B
What language does this grammar generate?

Q.5(a) Draw block diagram of Pushdown automata. [2]
(b) Design a PDA that will recognize string of {a,b,c} such that sum of number of a's and number of b's is equal to number of c's. [4]
(c) Prove that for every CFG there exists an equivalent PDA. [6]

Q.6(a) Describe multi tape Turing Machine. [2]
(b) Design a TM to recognize string of form $wc^iw^r \mid i>=0$, w ε (a,b)* w^r is reverse string of w. [4]
(c) Design a TM to perform addition of 2 binary numbers of different lengths. [6]

Q.7(a) State Arden's theorem. [2]
(b) Explain Halting problem of TM with suitable example. [4]
(c) Write short notes on: 1. Pumping Lemma 2. Ambiguous Grammar [6]

********28.11.18******E**