B.E. Computer Science & Engineering (Model Curriculum) Semester - V
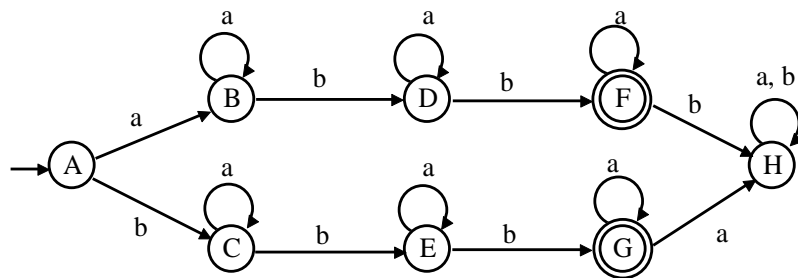# TEE103CS / TE103CS - Formal Language and Automata Theory

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Notes : 1. All questions are compulsory.
2. All questions carry equal marks.
3. Due credit will be given to neatness and adequate dimensions.
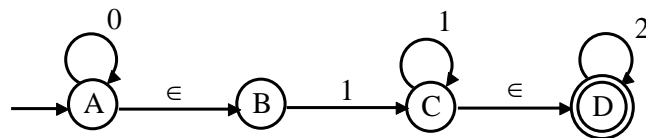4. Assume suitable data wherever necessary.

1. a) Discuss Chomsky Hierarchy in detail. **6**

b) Construct a DFA which accept all the string over $\Sigma = \{a, b\}$ which contains a substring **10**
'bab' and does not contain a substring 'bbb'.

OR

2. a) Find the Regular expression for following DFA. **8**

b) Convert the following FA to DFA. **8**

3. a) Convert the following grammar to Chomsky Normal form.

$S \rightarrow ASA \mid aB$

$A \rightarrow B \mid s$

$B \rightarrow b \mid \in$

b) Explain Ambiguous grammar. Check the following grammar is ambiguous or not. If it is an **6**
ambiguous remove it.

$S \rightarrow S * S$

$S \rightarrow S + S$

$S \rightarrow id$

OR

4. a) Reduce the following grammar. **6**

$S \rightarrow aA \mid aBB$

$A \rightarrow aaA \mid \in$

$B \rightarrow bB \mid bbC$

$C \rightarrow B$

b) Convert the following grammar to Greibach Normal from. **6**

$$E \rightarrow E + T \,|\, T$$
$$T \rightarrow T * F \,|\, F$$
$$F \rightarrow (E) \,|\, id$$

c) Discuss the Closure properties of context free language. **4**

5. a) Construct DPDA that accepts the language of a string with the same number of zeros and ones over $\Sigma = \{0, 1\}$. **8**

b) Describe linear Bounded Automata [LBA] in detail with suitable example. **8**

OR

6. a) Discuss the closure properties of context sensitive language. **6**

b) Differentiate between DPDA and NPDA. **4**

c) Construct PDA for the language **6**
$$L = \{w \subset w^R \,|\, w \in \{a, b\}^*\},$$
    R : Reverse string

7. a) Design a Turing machine, which perform multiplication of two integers of any length. **10**

b) Explain the working of Turing Machine. **6**

OR

8. a) Design a Turing Machine to find 2's complement of any given binary number. **6**

b) Explain Halting problem in Turing machine. **6**

c) Explain multiTape Turing machine. **4**

9. a) Explain the properties of Recursive Enumerable language. Give the relation between recursive & recursive enumerable language. **8**

b) What is Post correspondence problem [PCP]? Decide whether the following (A, B) pair have a solution or not ? If yes give the solution. **8**
$$A = \{b, bab^3, ba\}, B = \{b^3, ba, a\}$$

OR

10. a) Define Ackermann's function compute A(2,3) **8**

b) Explain the following **8**
    a) Church's Hypothesis.   b) Rice theorem.

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