USN ☐☐☐☐☐☐☐☐☐☐

15CS/IS54

Fifth Semester B.E. Degree Examination, June/July 2019
Automata Theory and Computability

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions, choosing*
ONE full question from each module.

Module-1

1 a. Define the following : i) string ii) alphabet iii) language. (06 Marks)
   b. Design a deterministic finite state machine for the following language over $\sum = \{a, b\}$.
      i) $L = \{W \mid |W| \bmod 3 > |W| \bmod 2\}$
      ii) $L = \{w \mid W$ ends either with ab or ba$\}$. (10 Marks)

OR

2 a. Write a note on finite state transducers. (07 Marks)
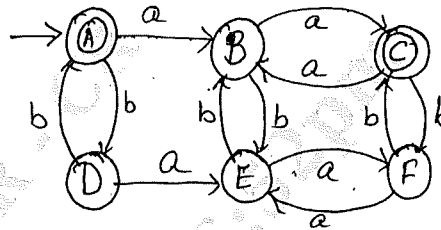   b. Define DFSM? Minimize the following FSM. [Refer Fig.Q2(b)]

Fig.Q2(b) (09 Marks)

Module-2

3 a. Write the equivalent Regular Expression for the given Finite state machine. [Refer Fig.Q3(a)] (08 Marks)
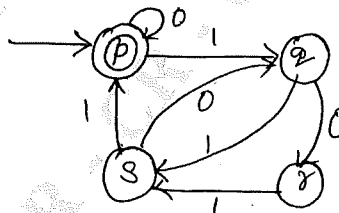

Fig Q3(a)

   b. Write the Regular Expression for the following language.
      i) $\{w \in \{a, b\}^*$ with atmost one a$\}$
      ii) $\{w \in \{a, b\}^*$ does not end with ba$\}$
      iii) $\{w \in \{0, 1\}^*$ has substring 001$\}$
      iv) $\{w \in \{0, 1\}^* \mid |W|$ is even$\}$. (08 Marks)

OR

4 a. State and prove the pumping theorem for regular language. (08 Marks)
   b. Show that the language $L = \{a^n b^n \mid n \geq 0\}$ is not regular. (08 Marks)

Module-3

5 a. Define grammar. Write the CFG for the following language.

i) $L = \left\{ w \in \{a, b\}^* \mid n_a(w) = n_b(w) \right\}$

ii) $L = \left\{ a^i b^j \mid i = j + 1 \right\}$. (08 Marks)

b. What is inherent ambiguity? Show that the language given is inherently amtriguous?

$L = \left\{ a^n b^n c^m \mid n, m \geq 0 \right\} \cup \left\{ a^n b^m c^n \mid n, m \geq 0 \right\}$. (08 Marks)

OR

6 a. Define PDA? Design PDA for the language $L = \left\{ a^n b^m a^n \mid n, m \geq 0 \right\}$. (06 Marks)

b. Convert the following language from CFG to PDA $L = \left\{ ww^R \mid w \in \{0, 1\}^* \right\}$. (06 Marks)

c. Convert the following CFG to CNF $E \rightarrow E + E \mid E * E \mid (E) \mid id$. (04 Marks)

Module-4

7 a. Prove that the language $L = \left\{ a^n b^n c^n \mid n \geq 0 \right\}$ is not context free. (08 Marks)

b. Prove that CFL are not closed under intersection, complement or difference? (08 Marks)

OR

8 a. Design a Turing machine to accept $L = \left\{ a^n b^n c^n \mid n \geq 0 \right\}$ (08 Marks)

b. Define a turning machine. Explain the working of a turning machine. (05 Marks)

c. Write a note on multitape machine. (03 Marks)

Module-5

9 Write a short notes on :

a. Growth rate of function (05 Marks)

b. Church-turning thesis (06 Marks)

c. Linear bounded automata. (05 Marks)

OR

10 Write a short notes on :

a. Post correspondence problem (05 Marks)

b. Halting problem in turning machine (05 Marks)

c. Various types of turning machine. (06 Marks)

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