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 $\Sigma = \{a, b\}$.

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)]

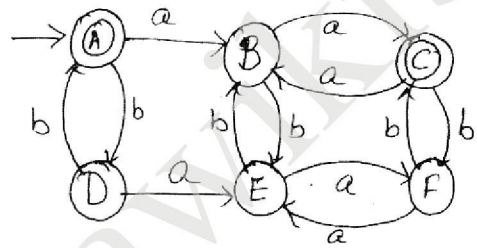

Fig.Q2(b) **(09 Marks)**

Module-2

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

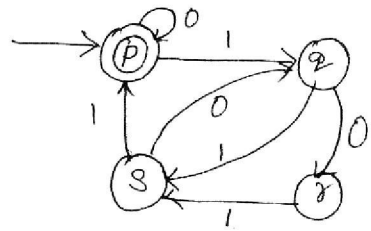

Fig Q3(a)

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) $L = \{ w \in \{a, b\}^* \mid n_a(w) = n_b(w) \}$
ii) $L = \{ a^i b^j \mid i = j+1 \}$. **(08 Marks)**

b. What is inherent ambiguity? Show that the language given is inherently amtriguous?
$L = \{ a^n b^n c^m \mid n, m \geq 0 \} \cup \{ a^n b^m c^n \mid n, m \geq 0 \}$. **(08 Marks)**

OR

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

b. Convert the following language from CFG to PDA $L = \{ ww^R \mid w \in \{0, 1\}^* \}$. **(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 $L = \{ a^n b^n c^n \mid n \geq 0 \}$ 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 $L = \{ a^n b^n c^n \mid n \geq 0 \}$. **(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)**