Candidate Seat no…….

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

Sixth Semester of B. Tech (CE) Examination

September 2018

CE306/CE306.01 Theory of Computation (TOC)

Date: 22.09.2018, Saturday **Time: 10.00 a.m. To 01.00 p.m.** **Maximum Marks: 70**

Instructions:

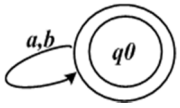
1. The symbols used carry their usual meanings.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Rough work is to be done in the last page of main supplementary, please don't write anything on the question paper.
5. Indicate clearly, the option(s) you attempt along with its respective question number.
6. Figures to the right indicate marks.

SECTION – I

Q - 1 Do as directed:

a. State True/False with reason: Deterministic Finite Automata can have more than one accepting state. **[02]**

b. Consider the Finite Automata M given below & state T/F for the following statements with reasons: **[02]**



a. M accepts a Null String
b. M accepts all strings over {a, b}
c. M is a deterministic FA
d. M is an NFA

c. Define: Equivalence Relation **[02]**

d. What are the differences between Moore Machine & Mealy Machine? **[02]**

e. Convert the following regular expression to deterministic finite automata. **[03]**

$$(a^*|b^*)^*$$

Q – 2 Answer the following questions (Any Three). [12]

a. Use mathematical induction to prove that $1 + 2 + 3 + ... + n = n (n + 1) / 2$ for all positive integers n.

b. State and prove Kleene's theorem – part I.

c. Show and explain in detail the procedure to convert NFA -^ to NFA with example.

d. State the pumping lemma for regular language. Prove that $\{0^n1^n \mid n>=0\}$ is not a regular language.

Q - 3 Answer the following questions (Any Three). [12]

a. Write and explain an algorithm to minimize the given DFA in detail with an appropriate example.

b. What is a proof? Prove by Contradiction: For any set A, B and C, if A∩B=∅ and C is a subset of B then A∩C=∅.

c. An NFA with states 1-5 and input alphabet {a, b} has the following transition table.

Q	δ (q, a)	δ (q, b)
1	{1, 2}	{1}
2	{3}	{3}
3	{4}	{4}
4	{5}	∅
5	∅	{5}

Find:

a. Draw Transition Diagram
b. Calculate $\delta^*(1, ab)$

d. Obtain a Deterministic Finite Automata to accept strings of a's and b's having even number of a's and b's.

SECTION – II

Q - 4 Do as directed:

a. Compare Turing Machine with FA and PDA. **[03]**

b. "Non-Determinism adds power to a NFA". Justify the correctness or falsehood of the statement. **[02]**

c. Remove useless symbol from the given CFG: **[03]**

S →AB|a A →BC|b B →aB|C C →aC|B

d. Give applications of finite automata. **[03]**

Q – 5 Answer the following questions (Any Three). **[12]**

a. Find a regular expression for the set of all strings over {a, b}.

i) The language of all strings containing at least two a's

ii) The language of all strings containing at most two b's

b. Design a Turing Machine accepting language of even length palindrome over {0, 1}.

c. When a grammar is said to be an ambiguous grammar? Check whether the grammar G with production rules

$$X \rightarrow X+X \mid X*X \mid X \mid a$$

is ambiguous or not.

d. Define: "*Context Free Grammar*". What languages are generated by Context Free Grammar whose production rules are given below:

S → aSa , S →bSb ,

S →aa , S →bb

Q – 6 Answer the following questions (Any Three). **[12]**

a. Define: Turing Machine. Mention Input device, Output device and Storage device in Turing Machine. Also design a Turing Machine to accept language a^+.

b. Show using pumping lemma that the given language is not a CFL.

$L=\{a^n b^n c^n \mid n>=1\}$

c. Write down a CFG generating the given language.

(1) The set of odd-length strings in $\{a, b\}^*$ with middle symbol a

(2) The set of even-length strings in $\{a, b\}^*$ with two middle symbols equal

d. Convert the following context free grammar into the Chomsky normal form.

$S \rightarrow aXbX \quad X \rightarrow aY \mid bY \mid \wedge \quad Y \rightarrow X \mid c$