Candidate Seat no……

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

Sixth Semester of B. Tech (CE) Examination

November 2015

CE306/CE306.01 Theory of Computation (TOC)

Date: 27.11.2015, Friday **Time: 01.30 p.m. To 04.30 p.m.** **Maximum Marks: 70**

Instructions:

1. The question paper comprises of two sections.
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 Choose the appropriate option: **07**

1. (AUA) ∩ (B∩B) is
   A. A∩B
   B. A
   C. B
   D. None of the above
2. Finite Automata cannot have
   A. Accepting State
   B. Transition Function
   C. Starting State
   D. More than one transitions for same input from a state
3. Tautology is
   A. Always True
   B. Always False
   C. Partially True
   D. Partially False
4. Regular Expressions are closed under
   A. Union
   B. Intersection
   C. Kleen Star
   D. All of the above
5. Can a DFA simulate NFA?
   A. yes
   B. no
   C. sometimes
   D. depends on NFA

6. Pumping Lemma is used to decide whether Language L is
   A. Not a regular
   B. Regular
   C. Proved or not
   D. None

7. (00 + 01 + 10)(0+1)* represents
   A. Strings of not starting with 11
   B. Strings of odd length
   C. Strings starting with 00
   D. Strings of even length

Q – 2.a Answer the followings questions: **[04]**

1. Prove by Contradiction: For any set A, B and C, if A∩B=∅ and C is a subset of B then A∩C=∅.
2. The Principle of Mathematical Induction

Q – 2.b Answer the following questions (Any Two). **[10]**

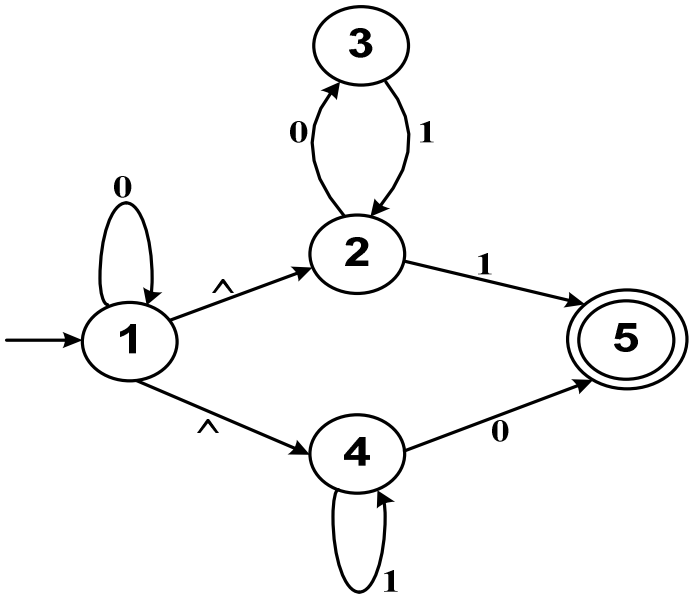
(i) Find DFA that recognizes set of all strings on ∑ ={a, b}, starting with prefix ab.

(ii) Prove that for every, n>=1,
7 + 13 + 19 + ……+ (6n+1) = n (3n+4) using PMI.

(iii) State and Prove Kleen's Theorem Part-I.

Q - 3 Answer any two questions. **[14]**

a. Convert the following NFA-∧ to DFA.



b. Suppose L_1 and L_2 are subsets of $\{0, 1\}^*$.
L_1= {x | x ends with 01}
L_2={x | x next to last symbol 0}
Find L_1- L_2.

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 $\delta^*(1, ab)$
c. Calculate $\delta^*(1, abaab)$

SECTION – II

Q - 4 Do as directed:

a. Show that the CFG with productions S→SS| (S) | ^ is ambiguous. **02**

b. Is it possible for a regular grammar to be ambiguous? Why? **01**

c. Let G be the grammar S →aB|bA, A→a|aS|bAA, B→b|bS|aBB. For the string aaabbabbba, Find: **04**
a) left most derivation tree
b) rightmost derivation tree

Q – 5.a Reduce the following grammar to CNF: **[04]**
S→ASA|bA A→ B|S B→c

Q – 5.b Answer the following questions (Any Two). **[10]**

(i) Design a Turing Machine accepting $\{a, b\}^*\{aba\}\{a, b\}^*$

(ii) What do you mean by context free grammar? In each case, find 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

(iii) Show using pumping lemma that the given language is not a CFL. $L=\{a^n b^n c^n \mid i>=1\}$

Q – 6 Answer any two questions. **[14]**

a. Define: Turing Machine. Mention Input device, Output device and Storage device in Turing Machine. Also design a Turing Machine to calculate f(x) = x+2.

b. Define: Push Down Automaton. Give transition table for deterministic PDA recognizing the language: { x belongs to {a, b}* | $N_a(x)=N_b(x)$}

c. Write down & Explain an algorithm to minimize the given DFA in detail with an appropriate example.