Note : 1) All Questions are compulsory.
       2) Figures to right indicate marks.

Q.1 A)   **Attempt all the questions.**   5 M

A.   Choose the correct alternatives.

i) Type 1 grammar is also called _____
   (a) Context dependent   (b) natural grammar.
   (c) context free   (d) regular grammar

ii) The set of all strings of 0's and 1's ending in 00 can be described by the regular expression -
   (a) $(01)^*\ 00$ (b) 01^*00
   (c) $(0+1)^*\ 00$ (d) $(0+1)^*(00)^*$

iii) An automaton in which the output depends only on the states of the machine is called a _____ machine.
   (a) Mealy   (b) Moore
   (c) Turing Machine   (d) All of the these

iv) PDA stands for _____.
   (a) Pull down automata   (b) Push direct automata
   (c) Push down automata   (d) Pull direct automata

v) The set { 1, 11, 111, ...} can also be represented by _____
   (a) 1^* (b) 1^+
   (c) $(11)^*$ (d) $(11)^+$

B.   **Fill in the blanks. (Choose correct one from the Pool).**   5 M
   { accepting, PDA, Turing machine, tree, regular, non-regular, initial, final}

i) Context free grammar can be represented using _____.
ii) Final state is also called _____ state.
iii) Context free languages (Type – 2) can be accepted by _____.
iv) The language L = {a^p | P is a prime } is _____
v) Finite automation can have more than one _____ state.

C.   **Explain following terms is one or two lines.**   5 M
i) If G is S $\rightarrow$ aS |a, then what is L (G)?
ii) Non-deterministic finite state machine
iii) Moore machine
iv) Chomsky Normal form
v) Pushdown Automaton

Q.2.   **Attempt any three of following.**   15 M
a. Write difference between DFA & NDFA.
b. Construct DFA that accepts sets of all strings over {0, 1} of length 2.
c. Write short note on Chomsky classification of grammar.
d. Construct a finite automaton equivalent to
   $(0+1)^*\ (00+11)\ (0+1)^*$
e. Define Ambiguous grammar. Find if grammar G with following productions is ambiguous?
          S $\rightarrow$ SbS | a
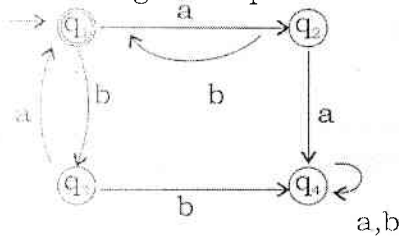f. Check these two automata are equivalent or not.
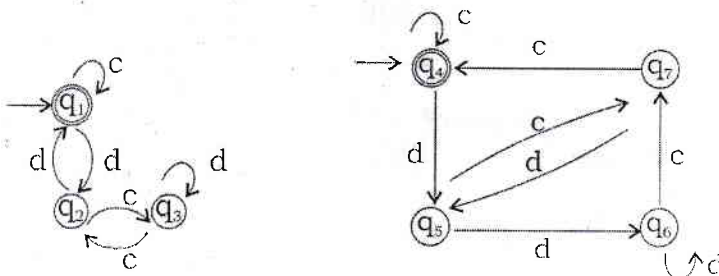
Q.3.   **Attempt any 3 of the following.**   15 M
a. State and prove Arden's theorem.
b. What is derivation tree? Generate derivation tree for string aabaa using

grammar G

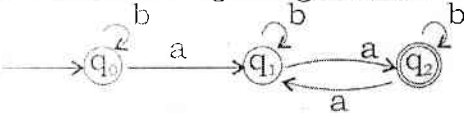$S \rightarrow aAS \mid a \mid SS$

$A \rightarrow SbA \mid ba$

c. Find regular expression for following DFA

d. Using pumping lemma, prove that the language
   $A = \{ a^n b^n \mid n \geq 0\}$ is not regular

e. Construct regular grammar G _____

f. Explain Leftmost derivation & rightmost derivations.

Attempt any three of the following.   **15M**

a. Write note on model of linear bound automata.

b. Write short note on "Variants of Turing Machine".

c. Design Turing machine that accepts
   $\{0^n 1^n \mid n \geq 1 \}$

d. Construct PDA accepting $L = \{ WCW^T \mid W \in \{a,b\}^*\}$

e. Write note on properties of recursive languages.

f. What is structure and operation of push down automata.

Attempt any three of the following.   **15M**

a. Let G be grammar –
   $S \rightarrow 0B \mid 1A$
   $A \rightarrow 0 \mid OS \mid 1AA$
   $B \rightarrow 1 \mid 1S \mid 0BB$
   For string 00110101 find
   (a) Leftmost derivation
   (b) Rightmost derivation

b. Prove that grammar G –
   $A \rightarrow A + A \mid A - A \mid a$
   Is ambiguous for string a + a+a

c. Convert given mealy m/c into Moore m/c

Present state	Next State			
	A = 0		A = 1	
	State	Output	State	Output
$\rightarrow q_1$	q_3	0	q_2	0
q_2	q_1	1	q_4	0
q_3	q_2	1	q_1	1
q_4	q_4	1	q_3	0

Write not on "Halting Problems"

What is regular set? Is $L = \{ a^{2n} \mid n \geq 1\}$ regular?

Write not on "Operations on language."