Duration: 3 hrs **[Max Marks: 80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 **[20]**

a Differentiate Finite Automata, Push Down Automata and Turing Machine.

b Discuss different applications of Finite Automata

c Design DFA that accepts Strings with at least 3 a's. over $\sum$={a,b}.

d Simplify the given grammar
S → ASB | ϵ
A → aAS | a
B → SbS | A | bb

2 a Compare and Contrast Moore and Mealy Machines. Design Moore machine for $\sum$={0,1}, print the residue modulo 3 for binary numbers. **[10]**

b Design Push Down Machine that accepts $L = \{a^m b^n c^n d^m \mid m, n>0\}$ **[10]**

3 a i) Construct CFG for given language. $L = \{ 0^i 1^j 0^k \mid j>i+k\}$ **[10]**
ii) The grammar G is S → aB | bA A → a| aS | bAA B → b | bS | aBB
Obtain parse tree for the following string "aababb" and check if the grammar is ambiguous.

b Explain Pumping Lemma with the help of a diagram to prove that given language is not a regular language. $L=\{0^m 1^{m+1} \mid m>0\}$ **[10]**

4 a i) Design DFA that accepts Strings that ends in either "110" or "101" over $\sum$={0,1}. **[10]**
ii) Design NFA that accepts strings starting with "abb" or "bba"

b Given NFA with epsilon, Find equivalent DFA. q1 is the initial state, q3 is final state **[10]**

	0	1	2	ϵ
→q1	{q1}	-	-	{q2 }
q2	-	{q2}	-	{ q3}
*q3	-	-	{ q3}	-

5 a Find Equivalent Greibach Normal Form (GNF) for given CFG. **[10]**
S → AA | a
A → SS | b

b Define and design Turing Machine to accept $0^n 1^n 2^n$ over $\sum$={0,1,2}. **[10]**

6 Write Short notes **(Any Two)** **[20]**

a Explain with example Chomsky Hierarchy.

b Post Correspondence Problem.

c Recursive and Recursive enumerable languages.

d TM-Halting Problem.
