Duration: 3 Hours **[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 Explain the ways of acceptance by a PDA. **[05]**

b Discuss difference in transition function of PDA, TM and FA **[05]**

c Design DFA that accepts Strings that contain "ba" or "ab" as suffix over ∑={a,b}. **[05]**

d Construct CFG to generate the language $L = \{a^i b^j c^k \mid k=i+j, i, j >=1\}$ **[05]**

2 a Represent RE epsilon for L = {w : w has prefix bab and suffix abb and w is a string over {a,b}. Design NFA with epsilon moves for accepting L. Convert it to minimized DFA. **[10]**

b Explain Pumping Lemma for regular languages. Prove that given language is not a regular language. $L=\{ a^n b^{n+1} \mid n>=1\}$ **[10]**

3 a The grammar G is $S \rightarrow aB \mid bA$, $A \rightarrow a \mid aS \mid bAA$, $B \rightarrow b \mid bS \mid aBB$
Derive using Left Most Derivation(LMD) and Rightmost Derivation (RMD) for the following string "aaabbb". Draw Parse Tree. **[10]**

b Give formal definition of Push Down Automata. Design PDA that accepts odd palidromes over {a,b,c}, where c exists only at the center of every string. **[10]**

4 a i) Design DFA that accepts Strings that are multiples of 4 ∑={0,1}. **[10]**
ii) Design NFA that accepts strings starting with a and ending with a or starting with b and ending in b.

b Design a Mealy machine to change every occurrence of a with x, b with y and c is kept unchanged. Convert the same to equivalent Moore machine. **[10]**

5 a Consider following CFG. Is it already simplified ? Explain you answer. Convert it to CNF form. **[10]**

$S \rightarrow ASB \mid a \mid bb$
$A \rightarrow aSA \mid a$
$B \rightarrow SbS \mid bb$

b Design a TM for converting a input binary number to its one's complement of a binary **[10]**

number.

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

a Chomsky Hierarchy

b Post Correspondence Problem.

c Arden's Theorem

d TM-Halting Problem.

e Variants of Turning Machines
