

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining **six** questions.
 (3) Assumptions made should be **clearly** stated.
 (4) **Figures** to the **right** indicate **full** marks.
 (5) Assume **suitable** data wherever required but **justify** the same.

- Q. No.1 a) Prove that 10
 i) $L = \{ (ab)^n a^k \mid n > k, k \geq 0 \}$ is not regular.
 ii) $L = \{ a^n b^n c^n \mid n \geq 1 \}$ is not context free.
 b) Convert the following ϵ -NFA to minimized DFA 10

Q	Σ	ϵ	a	b	c
\rightarrow p	-	-	{p}	{q}	{r}
q	{p}	{q}	{q}	{r}	-
* r	{q}	{r}	-	-	{p}

- Q.No.2 a) Convert the following grammar in chomsky normal form 10
 $S \rightarrow AACD$
 $A \rightarrow aAb \mid \epsilon$
 $C \rightarrow aC \mid a$
 $D \rightarrow aDa \mid bDb \mid \epsilon$
 b) Design the turing machine to recognize the language $L = \{ a^n b^n c^n \mid n \geq 1 \}$ 10

- Q.No.3 a) Prove that every nontrivial property of the RE languages is undecidable. 10
 b) Design the PDA for the language $L = \{ wcw^r \mid w \in \{a,b\}^* \}$ 10

- Q. No.4 a) Convert the following grammar in grebaic normal form 10
 $S \rightarrow AA \mid 0$
 $A \rightarrow SS \mid 1$
 b) Design moore machine to convert each occurrence of substring 1000 by 1001. 10

- Q.No.5 a) Convert the following expression grammar to PDA. 10
 $I \rightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
 $E \rightarrow I \mid E^*E \mid E+E \mid (E)$
 b) Write regular expression for the following languages. 05
 .i) $L = \{ a^n b^m \mid n \geq 4, m \leq 3 \}$ ii) $L = \{ w \mid |w| \bmod 3 = 0, w \in \{a,b\}^* \}$
 c) Write note on 'Universal turing machine' 05

- Q. No.6 a) Design TM which will recognize strings containing equal number of '0's and '1's. 10
 b) Design the DFA for the language, contains strings in which leftmost symbol differ from rightmost symbol. Σ is given $\{0,1\}$ 10

- Q. No.7 a) Design FSM for binary adder. 10
 b) Write short note on any two. 10
 (i) Post Correspondence Problem.
 (ii) Myhill-Nerode's Theorem.
 (iii) Halting problem.