

Duration: 3hrs

[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 Attempt any FOUR [20]
- a Design a FSM to accept string if it contains at least 3 a's over $\Sigma = \{a, b\}$.
- b Prove using Mathematical Induction that
- $$1 + 4 + 7 \dots + (3n - 2) = \frac{n(3n - 1)}{2}$$
- c Differentiate between DFA and NFA
- d Construct the context-free grammar corresponding to the regular expression
 $R = (00(001)^*10 + 001^*0)^*$
- e Prove that language $L = \{0^n10^n \text{ for } n = 0, 1, 2, \dots\}$ is not regular.
- 2 a Explain Warshall's algorithm. Consider the set $A = \{1, 4, 7, 13\}$ and $R = \{(1, 4), (4, 7), (7, 4), (1, 13)\}$. Find out the transitive closure of R using Warshall's algorithm. [10]
- b Design Mealy machine to change the occurrence of "120" to "122" over $\Sigma = \{0, 1, 2\}$ [10]
- 3 a Design FA for the following: [10]
 $S \rightarrow 0A \mid 1B \mid 0$
 $A \rightarrow 0S \mid 1$
 $B \rightarrow 1A \mid 0$
- b Draw the Hasse diagram of D_{60} and check if it is a lattice. [10]
- 4 a Design a DFA to check whether a ternary number is divisible by 3. [10]
- b Let $f(x) = 2x + 3$ and $g(x) = 3x + 4$ and $h(x) = 4x$ for $x \in R$, where $R =$ Set of real numbers. Find gof , fog , foh , hof and gofoh . [10]
- 5 a Explain PDA (Pushdown Automata) with Diagram and its Application. [10]
- b Define Euler path, Euler circuit, Hamiltonian path, Hamiltonian circuit. [10]
A connected planar graph has 9 vertices having degrees 2, 2, 2, 3, 3, 3, 4, 4 and 5. How many edges are there?
- 6 a Explain isomorphism in graph. Is it possible to draw a graph with 5 vertices of degree 1, 1, 2, 2, 4? [10]
- b Explain chomsky Hierarchy and chomsky Normal form in detail. [10]
