

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 Differentiate between Mealy and Moore Machine. [05]
- b Prove by Mathematical Induction $n^3 + 2n$ is divisible by 3 for $n \geq 1$ [05]
- c Let R be a relation on set of real numbers such that aRb , if and only if $a - b$ is an integer. Prove that R is an Equivalence Relation. [05]
- d Find the Leftmost derivation, rightmost derivation, Parse Tree from the input string $id + id * id$ from the following grammar. [05]
 $E \rightarrow E + E$
 $E \rightarrow E * E$
 $E \rightarrow id$
- e Draw an NFA with ϵ moves, for the regular expression $r = a \cdot (a + b)^*$, which represent the language consisting of strings a's & b's starting with a. [05]
- 2 a Define and give the Example of Injective, Surjective & Bijective function. [10]
 Check the Injectivity and Surjectivity for the following function.
 $f: N \rightarrow N$ given by $f(x) = x^2$
- b Consider a set $A = \{1,2,3,4,12\}$ & the relation of divisibility ie aRb if a divides b which denote $a | b$. Show that (A,R) is Poset. Construct Poset and also Draw Hasse Diagram. [10]
- 3 a Define with example Euler path, Euler circuit, Hamiltonian path, and Hamiltonian circuit. [10]
- b Obtain Disjunctive Normal Form of $p \wedge (p \rightarrow q)$ [05]
- c Prove that Statement $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology. [05]
- 4 a Construct a Mealy machine that accept the string ending in '00' and '11'. convert the same to Moore Machine. [10]
- b Write a short notes on Types of Grammar. [10]
- 5 a Design a finite automaton to check divisibility by 3 to binary number. [10]
- b Differentiate between NFA and DFA. [05]
- c Define regular expression and Describe it's any two properties. [05]

- 6 a Design PDA to check odd palindrome over $\Sigma = \{0,1\}$. [10]
 b Define Isomorphic Graph and state the condition of Graph Isomorphism. [10]
 Determine whether the following Graphs are Isomorphic.


