

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

I. Write short answers of the following:-

- Write short answers of the following:
- State Pumping lemma for regular sets.
 - What are epsilon transitions?
 - Give example of a CFG having useless symbols, unit productions and null productions.
 - What are tractable and intractable problems?
 - State the halting problem of Turing machines.

(2 × 5 = 10)

Section-A

II. a. The transition table of a nondeterministic finite automaton M is defined as follows. Construct a deterministic finite automaton equivalent to M.

State	0	1	2
→q ₀	q ₁ , q ₄	q ₄	q ₂ , q ₃
q ₁		q ₄	
q ₂			q ₂ , q ₃
q ₃ Final state		q ₄	
q ₄			

b. With the help of an example, describe the steps involved in minimizing the states of an automaton. (5, 5)

III.

- Eliminate all useless productions from the grammar:
 $S \rightarrow aS|AB$ $A \rightarrow bA$ $B \rightarrow AA$
- What do you mean by normal form for a context free grammar? Reduce the following grammar G into Greibach Normal Form (GNF). G is $S \rightarrow SS, S \rightarrow 0S1|01$. (4,6)

IV.

- What do you mean by closure properties of regular languages? List principal closure properties for regular languages.
- Using the pumping lemma for regular languages, show that $\{0^n 1^{2^n} | n > 0\}$ is not regular. (5,5)

Section-B

V.

- Let $L = \{a^m b^n | n < m\}$. Construct pushdown automata that accept the language L
 - by empty store
 - by final state
- Show that the language $L = \{a^m b^m c^n | m \leq n \leq 2m\}$ is not context free. (6,4)

VI.

- Describe multi-head and multi-tape Turing machines in detail.
- Prove that if L is a context free language, then there exists a PDA M that accepts the language L. (5,5)

VII.

- Write short notes on:
- Recursive and Recursively enumerable languages (5,5)
 - Polynomial time reductions