(Pages : 3) **M – 6113**

Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, December 2021

13.406 — FORMAL LANGUAGES AND AUTOMATA THEORY (R)

(2013 Scheme)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. Each question carries 4 marks.

1. Construct a finite automaton that accepts strings not ending in 1 from the set of strings in $(0+1)^*$.
2. Prove that the language $L = \{a^n b^n \mid n > 0\}$ is **not** regular.
3. Write notes on Chomsky hierarchy of languages.
4. Give a CFG that generates the language $L = \{0^n 1^{2n} \mid n > 0\}$.
5. Define Turing Machine. What are its uses?

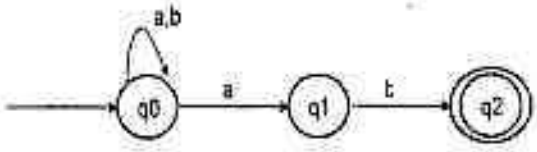
(5 × 4 = 20 Marks)

PART – B

Answer one full question from each module. Each question carries 20 marks.

Module I

6. (a) Convert the following NFA to DFA.



P.T.O.

(b) Define Moore machine. Design a Moore machine to output residue mod 4 (remainder of the input number when divided by 4) for binary input string treated as binary integer.

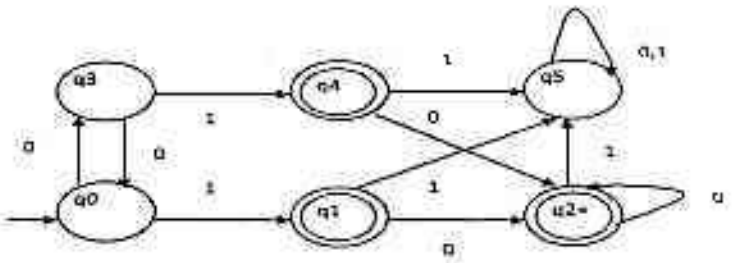
OR

7. (a) Show that if L is accepted by NFA with ε transitions, L can be accepted by an NFA without ε transitions.

(b) Let L be a set accepted by an NFA. Prove that there exists a DFA that accepts L. Is the converse true? Justify your answer.

Module II

8. (a) Minimize the following DFA.

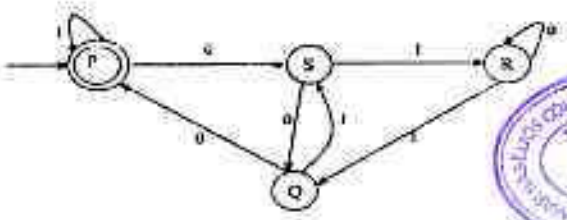


(b) State and prove pumping lemma for regular languages.

OR

9. (a) State and prove closure properties of regular sets.

(b) Obtain a regular expression for the FA given below.



Module III

10. (a) With a neat example, explain how CFG can be converted to Chomsky Normal Form.

    (b) Use pumping lemma to show that $L = \{a^n b^n c^n \mid n > 0\}$ is not context free.

OR

11. (a) Construct a PDA for $L = \{ww^R \mid w^R \text{ is the reverse of } w\}$.

    (b) Prove the equivalence between PDA and CFG.

Module IV

12. (a) Prove that if a language and its complement are both recursively enumerable, the language is recursive.

    (b) Design a TM that recognizes $L = \{a^n b^n c^n \mid n > 0\}$.

OR

13. (a) Explain the variants of Turing machines.

    (b) State halting problem of Turing machines. Prove that it is undecidable.

(4 × 20 = 80 Marks)