11. Construct a Turing Machine that will accept the language consists of all palindromes of 0's and 1's.

12. Define context free grammar. State and explain the closure properties of CFG.

13. $S \rightarrow aABB|aAA$, $A \rightarrow aBB|a$, $B \rightarrow bBB|A$, construct the PDA that accepts the language generated by given grammar.

MCA–302

December – Examination 2023

MCA (IIIrd Year) Examination

FORMAL LANGUAGE AND AUTOMATA

Paper : MCA–302

*Time : **3** Hours*] [*Maximum Marks : **80***

Note :– The question paper is divided into three Sections A, B and C. Write answers as per the given instructions.

Section–A **8×2=16**

(Very Short Answer Type Questions)

Note :– Answer all questions. As per the nature of the question delimit your answer in one word, one sentence or maximum up to **30** words. Each question carries 2 marks.

1. (i) Does push down automata have memory ? Give explanation.

   (ii) List the components of a Turing Machine.

(iii) Define unit production.

(iv) What is the significance of e-Moves ?

(v) What is Graph ? Give one example.

(vi) What are Universal Turing Machines ?

(vii) Give an example of undecidable problem.

(viii) What is Turing machine halting problem ?

Section–B **4×8=32**

(Short Answer Type Questions)

Note :– Answer any *four* questions. Each answer should not exceed **200** words. Each question carries 8 marks.

2. What do you mean by natural language processing ? How NLP is related to formal language and automation ? Discuss in detail.

3. Define Finite Automation. Explain about the model of Finite Automation.

4. If set A = {1, 2, 3} and relation defined on A as :

   (i) R1 = {(1, 1)(2, 2)(3, 3), (1, 2)(1, 3)(2, 3)}

   (ii) R2 = {(1, 1)(2, 2)(3, 3)}

   (iii) R3 = {(1, 1)(2, 3)(3, 1), (3, 2)(1, 3)(3, 3)}

   (iv) R4 = {(1, 3)(3, 1)(2, 3)(3, 2)}

Check whether the following relations are :

(a) Reflexive

(b) Symmetric

(c) Transitive

5. Explain the pumping lemma for regular sets. Show that L = $\{a^p \mid p \text{ is a prime}\}$ is not regular.

6. Discuss in brief about NP Hard problems.

7. Distinguish between Mealy and Moore machine.

8. Explain the procedure for constructing minimum state DFA with an example.

9. Discuss in brief about NP Hard Problems.

Section–C **2×16=32**

(Long Answer Type Questions)

Note :– Answer any *two* questions. You have to delimit your each answer maximum up to **500** words. Each question carries 16 marks.

10. Convert the following NFA to equivalent DFA (q_0 is the starting state and q_2 is final state) :