APRIL 2023 **57704/CS31A/MC41B**

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer any TEN questions.

1. Construct the truth table for $P \wedge (P \vee Q)$.

2. Express the statement "Every student in this class has studied calculus" as a universal qualification.

3. Draw a block diagram of a finite automation.

4. Define non - deterministic finite automation.

5. Construct a context free grammar for the given expression $(a+b)(a+b+0+1)^*$.

6. What do you meant by context — free grammar?

7. Write formal definition of PDA.

8. How do your convert CFG to a PDA?

9. Draw the Turing machine model.

10. What is multiple track Turing machine?

11. Write Universal Turing Machine.

12. Write what is chomsky hierarchy.

PART B — (5 × 5 = 25 marks)

Answer any FIVE questions.

13. Obtain the PCNF of

$(P \wedge Q \wedge R) \vee (7P \wedge Q \wedge R) \vee (7P \wedge 7Q \wedge 7R)$.

14. Construct a NFA equivalent to regular expression $(0+1)^*(00+11)$.

15. Construct an finite automata accepting all stings in $\{0,1\}^*$ having even number of 0's.

16. Show that $E \to E + E|E^* E|(E)id$ is ambiguous.

17. Construct a PDA that accepts the language generated by the grammar $S \to aABB$, $A \to aB|a, B \to bA|b$.

18. Construct a Turing machine that performs addition operation.

19. If L has a regular grammar, then prove than L is a regular set.

PART C — (4 × 10 = 40 marks)

Answer any FOUR questions.

20. Show that the following argument is valid "My father praises me only if I can be proud of myself. Either I do well in sports or I can not be proud of myself. If study hard, then I can not do well in sports. Therefore, if father praises me, then I do not study well.

21. State and prove equivalence of DFA and NDFA.

22. Find a Greibach normal form grammar equivalent to the following CFG $S \to AA|0, A \to SS|1$.

23. State and prove pumping lemma.

24. Construct PDA accepting $\{a^n b^m a^n / m, n \geq 1\}$ by empty stack.

25. If L is an r.e. language, then prove that $L = L(G)$ for some unrestricted grammar G.

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