NOVEMBER 2023 **57704/CS31A/ MC41B**

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer any TEN questions.

1. Write symbolic form of "If either Ram takes calculus of Krishna takes sociology, then Sita will take English".

2. State Pigeon hole principle.

3. Write any two characteristics of automation.

4. Is NDFA also DFA?

5. Write down the applications of context free grammar.

6. Let G be a grammar $S \to SbS / a$. Is G ambiguous?

7. Define Pushdown automata.

8. List any two applications of pumping lemma.

9. What is a Turing machine?

10. When is a function f is said to be Turing Computable?

11. What do you mean by BNF?

12. What is meant by deterministic PDA?

PART B — ($5 \times 5 = 25$ marks)

Answer any FIVE questions.

13. For all $n \geq 0$, prove that $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$

14. Construct a DFA accepting all strings over $\{a,b\}$ ending in ab.

15. Construct a a non-deterministic finite automata accepting $\{ab, ba\}$.

16. If G is the grammar $S \rightarrow SbS \mid a$, then show that G is ambiguous.

17. Construct a Push down automata accepting $L = \left\{wcw^T : w \in \{a,b\}^*\right\}$ final state.

18. Design a Turing machine to add two given integers.

19. Design a Turing machine to enumerate $\{0^n 1^n \mid n \geq 1\}$

PART C — (4 × 10 = 40 marks)

Answer any FOUR questions.

20. Show that $R \wedge (PVQ)$ is a valid conclusion from the premises $PVQ, Q \rightarrow R, P \rightarrow M$ and 7M.

21. How many positive integers n can be formed using the digits 3, 4, 4, 5, 5, 6, 7, if n has to exceed 50,00,000?

22. If L is the set accepted by NDFA then prove that there exists a DFA which also accepts L.

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

24. Construct Push down automata for the language $L = \{ww^R \mid w \text{ in } (0+1)^*\}$

25. Design a Turing machine to accept the language $L = \{0^n 1^n \mid n \geq 1\}$