Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION (Regular), MAY 2023

COMPUTER SCIENCE AND SYSTEMS ENGINEERING

(2021 Scheme)

Course Code: **21SE203**

Course Name: **Automata Theory and Computability**

Max. Marks: **60** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Design a NFA that accepts all strings containing 1100 as substring or set of all strings in which a pair of 1's is followed by a pair of 0's.
2. State and prove Pumping Lemma for regular languages.
3. Define the language acceptance by Pushdown Automata.
4. How does Turing Machine work as a Language Acceptor?
5. Define Time and Space Complexity of TM.
6. Differentiate between decidable and undecidable problems.
7. Show that travelling salesman problem is in class NP.
8. Outline the concept of polynomial time reductions.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. a) Convert the following NFA to DFA. (3)

State/Alphabet	0	1
->q0	q0	q1, q2
q1	q1, q2	q2
* q2	q0, q1	q1

b) Construct a DFA for the language over {0, 1}* such that it contains '000' as a substring. (3)

OR

10. a) Design DFA to accept strings over $\sum = (0,1)$ with two consecutive 0's. (3)

b) Prove or disprove that regular languages are closed under concatenation and complement. (3)

MODULE II

11. a) Let L = {w:w ε {0,1}* w does not contain 00 and is not empty}. Construct a regular expression that generates L (3)

b) Construct NFA for regular expression (1 + 0)0*. (3)

OR

12. a) Write Regular Expression for the set of strings over {0,1} that have atleast one 1. (3)

b) Prove by pumping lemma, that the language 0^n1^n is not regular. (3)

MODULE III

13. Consider the following grammar: (6)

S -> 0B|1A
A -> 0|0S|1AA
B -> 1|1S|0BB

Find left most derivation, rightmost derivation for string 00110101.

OR

14. Convert the following grammar G into GNF. (6)

S ->XA|BB
B ->b|SB
X ->b
A ->a

MODULE IV

15. a) Construct a Turing machine with no more than three states that accepts the language a(a+b)*. Assume Σ = {a,b} (4)

b) When is a Recursively Enumerable language said to be Recursive? (2)

OR

16. Explain about different types of turing machine. (6)

MODULE V

17. Prove that the halting problem of Turing machine is undecidable. (6)

OR

18. A DFA defines a decidable language. Justify. (6)

MODULE VI

19. Describe satisfiability problem. Show that satisfiability problem is in class NP. (6)

OR

20. Explain co- NP-PSPACE Complete Problem using a relevant example. (6)

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