STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086
(For candidates admitted during the academic year 2023 – 2024 & thereafter)

M.Sc. DEGREE EXAMINATION – APRIL 2026
INFORMATION TECHNOLOGY
FOURTH SEMESTER

COURSE : CORE
PAPER : FORMAL LANGUAGES AND FINITE AUTOMATA
SUBJECT CODE : 23CS/PC/FF44
TIME : 3 HOURS **MAX. MARKS: 100**

Q. No.	SECTION A Answer all the questions (10 x 2=20)	CO	KL
1.	What is a Finite state machine?	CO1	K1
2.	List the differences between DFA and NFA.	CO1	K1
3.	List the precedence of regular expression operators.	CO1	K1
4.	What are the various operations under which regular languages are closed?	CO1	K1
5.	Define ambiguous grammar.	CO1	K1
6.	Explain the structural requirements for a context-free grammar to conform to Chomsky Normal Form.	CO1	K2
7.	List the two ways by which Context Free Languages can be accepted by a Push Down Automata.	CO1	K2
8.	What is an Undecidable problem?	CO1	K2
9.	How is a finite state machine with output different from a finite state machine without output?	CO1	K2
10.	List the six tuple components of Moore machine.	CO1	K2
Q. No.	**SECTION B** **Answer all the questions (4 x 5=20)**	**CO**	**KL**
11.	a) Construct a DFA (both state transition diagram and table) for the language accepting strings having substring ‘110’ over input alphabets ∑={0, 1} **(OR)** b)Make use of an example to explain NFA.	CO2	K3
12.	a) Identify and explain the steps involved in converting a DFA to Regular Expression by eliminating states **(OR)** b) Identify and explain Regular expressions, their operators and the languages they accept.	CO2	K3
13.	a) Given the context-free grammar $G = (\{S\}, \{a, b\}, P, S)$with productions: • $S \rightarrow aSb$ • $S \rightarrow ab$ **(i)** Construct the leftmost derivation for the string *aaabbb*. **(ii)** Draw the corresponding parse tree for the string. **(OR)** b) Illustrate removal of ambiguity from a given context free grammar with necessary examples.	CO2	K3

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14.	a) Design a Turing Machine for the language $\mathbf{a^n b^n}$ **for n≥1** **(OR)** b) Examine the steps in converting a Mealy machine to a Moore machine.	CO3	K4
Q. No.	**SECTION C** **Answer all the questions (6 x 10=60)**	**CO**	**KL**
15	a) Construct a DFA from ε-NFA using subset construction method. **(OR)** b) State and prove equivalence of NFA and DFA.	CO2	K3
16	a) Discuss left most and right most derivations for a context free grammar. **(OR)** b) State and prove pumping lemma for regular languages.	CO3	K4
17	a)Discuss Deterministic Push Down Automata. **(OR)** b) Discuss Turing Machines with necessary examples.	CO3	K4
18	a)Explain the concept of decidability and undecidability in the context of Turing Machines. **(OR)** b) Discuss Mealy machine with necessary examples.	CO4	K5
19	a) Explain Chomsky Normal Form. **(OR)** b) Construct a Moore machine for a binary input such that if it has a substring 101, the machine outputs A, if it has a substring 110, it outputs B else C.	CO4	K5
20	a) Explain how a Regular Expression can be converted to a finite automata. **(OR)** b) Design a Push Down Automata for a language L $\mathbf{ww^r}$ (word and its reverse).	CO5	K6

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