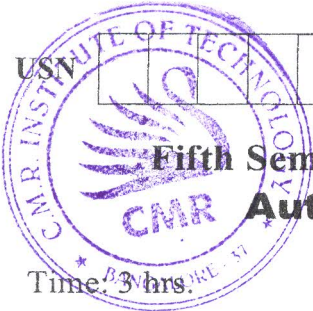


CBCS SCHEME

21CS51



Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Automata Theory and Compiler Design

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define the following terms :
 - i) String ii) Language iii) Alphabet iv) Length of string (04 Marks)
 - b. Explain the various phases of compiler with neat diagram. (08 Marks)
 - c. Define DFA and design a DFA to accept the following language:
 - i) To accept strings having even number of a's and odd number of b's.
 - ii) To accept strings of a's and b's not having the substring aab. (08 Marks)

OR

- 2 a. Design the equivalent DFA to the following ϵ -NFA.



(05 Marks)

- b. Minimize the following DFA by identifying distinguishable and non-distinguishable states.

δ	0	1
→ A	B	F
B	G	C
* C	A	C
D	C	G
E	H	F
F	C	G
G	G	H
H	G	C

(10 Marks)

- c. With neat diagram explain the components of language processing system in detail.

(05 Marks)

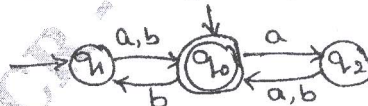
Module-2

- 3 a. Define Regular Expressions. Write a regular expressions for the following :

- i) $L = \{a^n b^m \mid n+m \text{ is even}\}$
- ii) The set of all strings whose 3rd symbol from right end is 0
- iii) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$

(10 Marks)

- b. Convert the following automata to a regular expression.



(04 Marks)

- c. Explain the concept of input buffering in the Lexical Analysis along with sentinels.

(06 Marks)

OR

- 4 a. State and prove Pumping Lemma for regular languages and also prove the language

$L = \{a^n b^n \mid n \geq 0\}$ is not a regular.

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. Construct ϵ -NFA for the following regular expression
 $(0 + 11) 0^* 1$ (04 Marks)
- c. Define Token, Lexeme and Pattern with example. (06 Marks)

Module-3

- 5 a. Define CFG. Write a CFG to the following languages.
 i) All strings over $\{a, b\}$ that are even and odd Palindromes.
 ii) $L = \{a^n \mid n \geq 0\}$ (10 Marks)
- b. Define ambiguity. Consider the grammar $E \rightarrow E + E \mid E * E \mid (E) \mid id$
 Construct the leftmost and rightmost derivation, parse tree for the string $id + id * id$.
 Also show that the grammar is ambiguous. (10 Marks)

OR

- 6 a. Consider the CFG given below with the production set, compute the following for the same.
 (i) First() and Follow() set (ii) Predictive Parsing table
 Grammar is,
 $E \rightarrow TE'$
 $E' \rightarrow +TE' \mid E$
 $T \rightarrow FT'$
 $T' \rightarrow *FT' \mid E$
 $F \rightarrow (E) \mid id$ (14 Marks)
- b. Write an algorithm to eliminate left recursion from a grammar. Also eliminate left recursion from the grammar
 $S \rightarrow Aa \mid b$
 $A \rightarrow Ac \mid Sd \mid \epsilon$ (06 Marks)

Module-4

- 7 a. Define PDA. Design PDA for the language $L = \{WCW^R \mid W \in (a, b)^*\}$ and also show the Instantaneous Description (ID) for the input $aabCbba$. (10 Marks)
- b. Construct LR(0) automata for the grammar given below.
 $S \rightarrow L = R \mid R$
 $L \rightarrow *R \mid id$
 $R \rightarrow L$ (10 Marks)

OR

- 8 a. Define shift reduce Parser and Handle. Also list and explain the different actions operations available in Bottom up parser. (10 Marks)
- b. Construct the LR(1) automata for the given grammar.
 $S \rightarrow AA$
 $A \rightarrow aA \mid b$ (10 Marks)

Module-5

- 9 a. Design a Turing machine to accept the language $L = \{0^n 1^n 2^n \mid n \geq 1\}$ (10 Marks)
- b. Write a short note on the following :
 (i) Post correspondence problem (ii) Design issues in code generation (10 Marks)

OR

- 10 a. Translate the arithmetic expression $a = b * -c + b * -c$ into
 (i) Three address code (ii) Quadruple (iii) Triple (10 Marks)
- b. Write a short note on :
 (i) Decidable language (ii) Halting problems in Turing machines. (10 Marks)
