CBCS SCHEME

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21CS51

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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 DFA. Construct DFA for the following languages:
i) L = {W : W is of even length and begin with 01}
ii) Accepts all strings on Σ = {0, 1} except those containing the substring 001 **(08 Marks)**

b. Discuss the various phases of compiler with suitable example. **(06 Marks)**

c. Convert the following NFA into DFA

	0	1
→p	{p, q}	{p}
q	{r}	{r}
r	{s}	ϕ
*s	{s}	{s}

(06 Marks)

OR

2 a. Draw the table of distinguishabilities for the below DFA. Construct the minimum state equivalent DFA.

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

(08 Marks)

b. Define ∈-closure of any state. Convert the following ∈-NFA into DFA.

	∈	a	b	c
→p	{q, r}	ϕ	{q}	{r}
q	ϕ	{p}	{r}	{p, q}
*r	ϕ	ϕ	ϕ	ϕ

(06 Marks)

c. Define the terms:
i) Alphabet
ii) String
iii) Language
iv) Empty string
v) Concatenation of strings
vi) Powers of an alphabet **(06 Marks)**

Module-2

3 a. Define regular expression. Write regular expression for the following:
i) Strings in which third symbol from the right end is 'b' on $\Sigma = \{a, b\}$
ii) $L = \{a^n b^m : n \geq 4 \text{ and } m \leq 3\}$
iii) $L = \{a^n b^m : n \geq 1, m \geq 1, nm \geq 3\}$ **(10 Marks)**

b. Show that the language consists of strings of a's and b's in which number of a's is less than number of b's is not regular. **(06 Marks)**

c. Discuss input buffering and sentinels. **(04 Marks)**

OR

4 a. Show that every language defined by a regular expression is also defined by a finite automata construct. ϵ-NFA for the regular expression $r = a^* + b^* + c^*$ **(10 Marks)**

b. Discuss lexemes, patterns and tokens with example. **(06 Marks)**

c. What is transition diagram? Write the transition diagram for unsigned number. **(04 Marks)**

Module-3

5 a. Define CFG. Write CFG for the following languages:
i) $L = \{0^i 1^j 0^k : j > i + k\}$
ii) $L = \{a^n b^m c^{n+m} : n, m \geq 0\}$ **(10 Marks)**

b. Write an algorithm to eliminate left recursion from the grammar. Apply the algorithm to the grammar
$S \rightarrow Aa/b$
$A \rightarrow Ac/Sd/\epsilon$ **(06 Marks)**

c. Show that the grammar is ambiguous $S \rightarrow aS/X$ $X \rightarrow aX/a$ **(04 Marks)**

OR

6 a. Define leftmost, rightmost derivation and Parce tree. Find leftmost and rightmost derivation and construct parse tree for the string "aaabbabbba" using the grammar,
$S \rightarrow aB/bA$ $A \rightarrow a/aS/bAA$ $B \rightarrow b/bS/aBB$ **(10 Marks)**

b. Discuss the rules to compute FIRST (X) and FOLLOW (A). Construct predictive parsing table for the grammar,
$S \rightarrow iEtSS^1/a$ $S^1 \rightarrow eS/\epsilon$ $E \rightarrow b$ **(10 Marks)**

Module-4

7 a. Construct canonical parsing table for the following grammar by constructing the collection of LR(1) items.
$S^1 \rightarrow S$ $S \rightarrow CC$ $C \rightarrow cC/d$ **(10 Marks)**

b. Construct LALR parsing table for the grammar
$S^1 \rightarrow S$ $S \rightarrow CC$ $C \rightarrow cC/d$ **(10 Marks)**

OR

8 a. Write canonical collection of sets of LR(0) items. Illustrate the actions of a shift-reduce parser on input id $*$ id

$E \to E + T / T \quad T \to T * F/F \quad F \to (E) / id$ **(10 Marks)**

b. Define NPDA. Construct NPDA for the language $L = \{WCW^R : W \in \{a,b\}^*\}$. Show the sequence of moves in accepting the string abcba **(10 Marks)**

Module-5

9 a. What are syntax directed definitions? Give SDD of a simple desk calculator. **(06 Marks)**

b. Discuss three address code with an example. **(06 Marks)**

c. Write a note on:

i) Multitape Turing Machine

ii) Recursive Language **(08 Marks)**

OR

10 a. Differentiate between S-attributed and L-attributed definitions. **(04 Marks)**

b. Discuss any three issues in the design of a code generator. **(06 Marks)**

c. Define Turing Machine. Construct Turing Machine for the language $L = \{a^n b^n c^n : n \geq 0\}$ **(10 Marks)**

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