



PG (CBCS)
M.Sc Semester- II Examination, 2023
COMPUTER SCIENCE
PAPER: COS 202

(THEORY OF COMPUTER SCIENCE AND COMPILER DESIGN)

Full Marks: 40

Time: 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Write the answer for each unit in separate sheet

M1: THEORY OF COMPUTER SCIENCE

GROUP-A

1. Answer any **TWO** from the following questions: 2×2=4
- Construct a minimal DFA for the regular language $L = \{w \mid w \in \{a, b\}^*, \text{ number of } b\text{'s in } w \text{ is divisible by } 3\}$.
 - Prove that $(1+00^*1) + (1+00^*1)(0+10^*1)^* (0+10^*1) = 0^*1(0+10^*1)^*$.
 - Explain Chomsky Hierarchy.
 - State any two properties of CFL's.

GROUP-B

2. Answer any **TWO** from the following questions: 2×4=8
- Construct a Moore machine equivalent to the Mealy machine defined by the following table:

Present State	Next State			
	Input a=0		Input a=1	
	State	Output	State	Output
→ q1	q3	0	q2	0
q2	q1	1	q4	0
q3	q2	1	q1	1
q4	q4	1	q3	0

- Show that $L = \{a^p \mid p \text{ is a prime number}\}$ is not regular.
- Reduce the following grammar to CNF:
 $S \rightarrow aAD, A \rightarrow aB \mid bAB, B \rightarrow b, D \rightarrow d$
- Define ambiguous grammar. Show that the following grammar is Ambiguous
 $S \rightarrow aSbS \mid bSaS \mid \epsilon$

(P.T.O)

3. Answer any ONE from the following questions:

GROUP-C

(2)

- a) i) Construct a FA for the RE $10 + (0+11)0^*1$. 1×8=8
 ii) Construct a PDA which accepts the following context free language $L = \{a^n b^m c^n \mid m, n \geq 1\}$ 4+4

- b) i) Minimize the following FA by using equivalent method. 5+3

Present state	Next State	
	I/P=0	I/P=1
→ A	E	C
B	C	A
C	B	G
D	G	A
E	F	B
F	E	D
Ⓞ G	D	G

- ii) Find an equivalent grammar without any null production:

$S \rightarrow aA \mid bB \mid AB$
 $A \rightarrow aA \mid \epsilon$
 $B \rightarrow bB \mid \epsilon$

M2: COMPILER DESIGN

GROUP-A

4. Answer any TWO from the following questions: 2×2=4

- a) Differentiate tokens, patterns and lexeme.
 b) Define decorated parse tree.
 c) What is Bootstrapping?
 d) What do you mean by symbol table?

(P.T.O)

5. Answer any TWO from the following questions:

GROUP-B

(3)

- a) Consider the following Grammar:
 $S \rightarrow Aa \mid b$
 $A \rightarrow Ac \mid Sd \mid f$
 Remove left recursion.
- b) Calculate FIRST and FOLLOW for the following grammar?
 $S \rightarrow aBDh$
 $B \rightarrow cC$
 $C \rightarrow bC \mid \epsilon$
 $D \rightarrow EF$
 $E \rightarrow g \mid \epsilon$
 $F \rightarrow f \mid \epsilon$
- c) Consider the assignment $a = b^* - c + b^* - c$. Draw the syntax tree and the DAG.

GROUP-C

6. Answer any ONE from the following questions: 1×8=8

- a) i) Consider the following grammar: 6+2
 $S \rightarrow aAd \mid ace \mid bAe$
 $A \rightarrow c$

Construct the SLR (1) parsing table for this grammar. Is this grammar SLR (1)?

What is the difference between SLR, CLR and LALR parsers?

- ii) Construct basic blocks and data flow graph for the following code snippet 4

```

for (i=1 to n)
{
  j=1;
  while(j<=n)
  {
    A=B*C/D;
    j=j+1;
  }
}

```

- ii) Construct LALR table for

$S \rightarrow S$
 $S \rightarrow aAd/bBd/aBc/bAc$
