

S → ABC | E

A → aA | b

B → bBd | ddd

C → cC | e



Daffodil International University
Faculty of Science & Information Technology
Department of Software Engineering
Final Examination, Summer 2026

Course Code: SE234 Course Title: Theory of Computing

Sections & Teachers: DDK (A-C), KRY (D, N-O), SHN (E-H), AMR (I-L), AAA (M)

Time: 2:00 Hrs

Marks: 40

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	Demonstrate the regular language for the following expression and show one supported and one not supported string: i. $1^* (011^*)^*$ ii. $(0+1)^* 1 (0+1) (0+1)$	[Marks-2+2=4]	CLO-3 Level-3
	b)	Construct an ϵ -NFA equivalent to the following regular expression using the lemma method. $R = (0+11)^* + (01+10)^*$	[Marks-6]	
	c)	Construct a context-free grammar (CFG) for the following language: $L = \{ab^n c^m d^{n+m+1} \mid n, m \geq 0\}$	[Marks-4]	
	d)	Show the Leftmost derivation and then construct a Parse Tree for the string <u>aabbabba</u> using the following context-free grammar: $S \rightarrow aB \mid bA$ $A \rightarrow a \mid aS \mid bAA$ $B \rightarrow b \mid bS \mid aBB$	[Marks-3+3=6]	
	e)	Consider the following context-free grammar: $S \rightarrow AB \mid C$ $A \rightarrow aA \mid a$ $B \rightarrow aB \mid b$ $C \rightarrow aCb \mid ab$ Examine whether it is ambiguous by considering the string <u>aaaaab</u> .	[Marks-5]	
	f)	Construct a Pushdown Automata (PDA) that accepts the following language: $L = \{wcw^R \mid w \in \{a, b\}^*\}$, where w^R denotes the reverse of w . Clearly show the state diagram and transition functions of the PDA.	[Marks-6]	
	g)	For the PDA constructed in Question 1(f), trace the input string <u>abbabcbabba</u> by showing the current state, remaining input, and stack content after each transition.	[Marks-4]	
2.	a)	Provide the formal definition of a Turing Machine as a 7-tuple and briefly explain each component.	[Marks-2]	CLO-4 Level-3
	b)	Draw and label the basic components of a Turing Machine, and briefly describe the function of each component.	[Marks-3]	