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S → ABC | ε
A → aA | b
B → bBd | ddd
C → cC | ε

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 *aabbabba* 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 *aaaaab*.	[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 *abbabcbabba* 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]	