



**University of Engineering & Management, Kolkata**  
**2<sup>nd</sup> Term Examination, November, 2023**  
**Programme Name: B.Tech in CSE / CSE (AIML) / CSE (IOT, CYS, BCT)**  
**Semester: 5<sup>th</sup>**  
**Course Name: Formal Language and Automata Theory**  
**Course Code: PCCCSE502**

**Full Marks: 30**

**Date: 8<sup>th</sup> November, 2023**

**Time: 1.30 pm – 2.30 pm**

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**Part - A**  
**Attempt 5 questions**  
**Each question carries 2 Marks (2 X 5)**

**1.A. Define the mathematical definition of a DPDA.**

**Or**

**1.B. Define the mathematical definition of a NDPDA.**

**2.A. Quote the Ogden's Lemma.**

**Or**

**2.B. Quote the Pumping Lemma of the CFL.**

**3.A. Describe the mathematical definition of a DCFL.**

**Or**

**3.B. Describe the mathematical definition of a NDCFL.**

**4.A. Identify the differences between Deterministic Turing Machine and the Non-Deterministic Turing Machine.**

**Or**

**4.B. State the Church-Turing Hypothesis.**

**5.A. State PDA acceptance by empty stack and final state.**

**Or**

**5.B. Discuss the closure properties of the CFL.**

**Part - B**  
**Attempt 2 questions**  
**Each question carries 5 Marks (5 X 2)**

**6.A.** Construct an algorithm to convert a CFG into a CNF.

**Or**

**6.B.** Construct the left-most and right-most derivations for the following grammar  
 $S \rightarrow aB \mid bA$   
 $A \rightarrow aS \mid bAA \mid a$   
 $B \rightarrow bS \mid aBB \mid b$  which accepts the string "aaabbabbba"

**7.A.** Prove that the language is not a CFL:  $L = \{\omega.\omega \mid \omega \in \{a,b\}^*\}$

**Or**

**7.B.** What is meant by ambiguous grammar? Test whether the grammar is ambiguous or not.  
 $S \rightarrow A \mid B$   
 $A \rightarrow aAb \mid abB$   
 $abB \mid \epsilon$

**Part - C**  
**Attempt 1 question**  
**Each question carries 10 Marks (10 X 1)**

**8.A.** Design a PDA for the given language:  $L = \{a^n b^n \mid n \geq 0\}$

**Or**

**8.B.** Design a PDA for the given language:  $L = \{a^n b^m c^l \mid n, m, l \geq 0\}$

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