INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SONEPAT

भारतीय सूचना प्रौद्योगिकी संस्थान सोनीपत

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Mid Sem-I | **Subject: AFL** | **Roll no ……**

Branch: CSE & IT | **M.M.-15 marks** | **Time- 60 mint.**

Note: All questions are compulsory.

Q.[1] (a)Construct right-and left-linear grammars for the language $L=\{a^n b^m : n \geq 2, m \geq 3\}$ **1.5**

Q.[1] (b) Obtain the production rules for CFG gfor the given language generated as **1.5**

(a) $L(G) = \{ w \mid w \in \{a, b\}^*, n_a(w) = n_b(w) \}$

(b) $L(G) = \{ w \mid w \in \{a, b\}, n_a(w) = 2\, n_b(w) \}$

(c) $L(G) = \{ w \mid w \in \{a, b\}, n_a(w) = 3\, n_b(w) \}$

Q.[2](a) Obtain the language generated by each of the following production rules. **2**

(a) $A \rightarrow a$
$A \rightarrow aB$
$A \rightarrow \in$

(b) $S \rightarrow aS$
$S \rightarrow \in$

(c) $A \rightarrow a$
$A \rightarrow aB$
$A \rightarrow \in$

(d) $A \rightarrow aS$
$S \rightarrow bS$
$S \rightarrow \in$

(e) $S \rightarrow aS$
$S \rightarrow bS$
$S \rightarrow a$

(f) $S \rightarrow ab$
$S \rightarrow bs$
$S \rightarrow a$
$S \rightarrow b$

Q.[2](b)Convert the following PDA into an equivalent CFG. **2**

δ(q0 , a, z0) → (q1, z1z0)

δ(q0, b, z0) → (q1, z2z0)

δ(q1, a, z1) → (q1, z1z1)

δ(q1, b, z1) → (q1, λ)

δ(q1, b, z2) → (q1, z2z2)

δ(q1, a, z2) → (q1, λ)

δ(q1, λ, z0) → (q1, λ) // accepted by the empty stack

Q.[3](a) Convert the following CFG in Chomsky Normal Form (CNF) **2**

S → aA/bB

A → aBB/bS/b

B → bAA/aS/a

Q.[3](b) Convert the following CFG into GNF. **2**

S → XY

X → YS/b

Y → SX/a

Q.[4](a) Given **L ={a^n b^m | n < m}.** **2**

Derive (i) a context-free grammar that accepts L

(ii) a PDA accepting L by empty store

(iii) a PDA accepting L by final state.

Q.[4](b) Construct an equivalent PDA for the following context-free grammar. **2**

S → aAB/bBA

A → bS/a

B → aS/b

Show an ID for the string ***abbaaabbbbab*** for the PDA generated with stack description.