6) $E \to E + E$

$E \to E * E$

$E \to id$

$w = id + id$ = LMD

$w = id + id * id$ = RMD

$\Rightarrow$ LMD

$E \to E + E$

$\to id + E$

$\to id + id$

RMD

$E \to E + E$

$\to E + E * E$

$\to E + E * id$

$\to E + id * id$

$\to id + id * id$

Q.2. Find the language generated by following grammar.

1) $A \to \alpha A | \beta$

→ $A \to \beta$ $\alpha^0\beta$

$A \to \alpha A$ $\alpha^1\beta$

$\to \alpha\alpha A$ $\alpha^2\beta$

$\to \alpha\alpha\alpha A$ $\alpha^3\beta$

$\vdots$

$L = \alpha^*\beta$

$A \to \alpha A|\beta \Leftrightarrow A \to \alpha^*\beta$

2) $A \to A\alpha | \beta$

→ $A \to A\alpha$

$\to \beta\alpha$

$A \to A\alpha$

$\to A\alpha$

$\to A\alpha\alpha$

$\to \beta\alpha\alpha$

$L = \{ \beta\alpha^*$

3) $A \to A\alpha | \alpha$

$A \to \alpha_{-}\alpha^*$ [$\because q.q^* = q^+$]

$\to \alpha^+$

$L = \alpha^+$

4) $A \to \alpha A \mid \alpha$

→ $A \to \alpha$

$A \to \alpha A$

$A \to \alpha\alpha A$

$A \to \alpha\alpha\alpha$

$A \to \alpha.\alpha^*$

$\to \alpha^+$

$\therefore L = \alpha^+$

5) $A \to A\alpha \mid \epsilon$

→ $A \to \epsilon.\alpha$

$A \to \alpha$

$A \to A\alpha$

$\to A\alpha\alpha$

$\to A\alpha\alpha\alpha$

$\to \epsilon.\alpha\alpha\alpha$

$\to \epsilon.\alpha^*$

$\to \alpha^*$

$\therefore L = \alpha^*$

6) $S \to AB$

$A \to aA \mid \epsilon \to a^*$

$B \to bB \mid \epsilon \to b^*$

$S \to AB$
$\to a^*b^*$

$S \to AB$
$\to aAB$
$\to aAbB$
$\to aaAbbB$
$\to aa\epsilon bb\epsilon$
$\to aabb$
$\to a^*b^*$

$\therefore L = \{a^m b^n \mid m, n \geq 0\}$

7) $S \to aA$

$A \to bA \mid \epsilon \Rightarrow b^*$

$S \to aA$
$\to ab^*$

$L = ab^*$

$\therefore L = \{ab^n \mid n \geq 0\}$

$S \to aA$
$\to abA$
$\to abbA$
$\to abb\epsilon$
$\to abb$
$\to ab^*$

8) $S \to aSb \mid \epsilon$

$\to S \to \epsilon$

$S \to aSb = ab$
$\to aaSbb = a^2b^2$
$\to aaaaSbbbb = a^3b^3$
$\vdots$
$\to aaa\epsilon bbb$
$\Rightarrow aaabbb$ a^nb^n

$\therefore L = a^*b^*$

$L = \{a^nb^n \mid n \geq 0\}$

9) $S \to aS \mid bS \mid \epsilon$

$\Rightarrow$ $S \to aS$ $\quad$ $S \to bS$

$\to aaS$ $\quad$ $\to bbS$

$\to aaaS$ $\quad$ $\to bbbS$

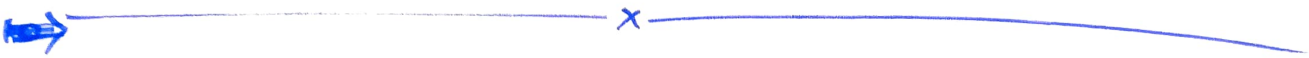
$\to aaa$ $\quad$ $\to bbb$

$\Rightarrow S \to (a+b)S \mid \epsilon$

$\to (a+b)(a+b)S$

$\to (a+b)^*$

$\therefore L = (a+b)^*$



Q.3 Construct the grammar for the following language.

1) $L = \{a, ab\}$ $\quad \Sigma = \{a, b\}$

$\Rightarrow$ $S \to aX$

$X \to \epsilon \mid b$

$w = aX$

$\epsilon \quad b$

2) $L = \{\underline{ab}, \underline{aba}, \underline{bab}\}$

$\quad\quad x \quad\quad x \quad\quad x$

$\to$ $S \to X \mid Xa \mid bX$

$X \to AB$

$A \to a$

$B \to b$

3) $L = \{\underline{aab}, \underline{aba}, \underline{abb}\}$

$\quad\quad x \quad\quad x \quad\quad x$

$\to$ $S \to aX \mid Xa \mid Xb$

$X \to AB$

$A \to a$

$B \to b$

4) $L = \{aba, bab, bba, abab, ba\}$

X X Y X X Y

$\Rightarrow$

$S \rightarrow Xa \mid bX \mid bY \mid XX \mid Y$

$X \rightarrow AB$

$Y \rightarrow BA$

$A \rightarrow a$

$B \rightarrow b$

5) $L = \{2@3, 2-3, 3\#2, 3*2, 2\$3\}$

X Y X Y Y X Y X X Y

$\rightarrow$

$S \rightarrow XAY \mid YBX$

$X \rightarrow 2$

$Y \rightarrow 3$

$A \rightarrow @ \mid - \mid \$$

$B \rightarrow \# \mid *$