

**Department of Computer Science and Engineering, SVNIT, Surat.**  
**Automata and Formal Languages**  
**Tutorial 5**  
**Topic: Context Free Grammar**

Q. Convert following grammar into CNF

1.  $S \rightarrow BAB \mid B \mid \varepsilon$   
 $B \rightarrow 00 \mid \varepsilon$

2.  $S \rightarrow aAbB$   
 $A \rightarrow aA \mid a$   
 $B \rightarrow bB \mid b$

3.  $S \rightarrow 1A \mid 0B$   
 $A \rightarrow 1AA \mid 0S \mid 0$   
 $B \rightarrow 0BB \mid 1S \mid 1$

4.  $S \rightarrow aAD$   
 $A \rightarrow aB \mid bAB$   
 $B \rightarrow b$   
 $D \rightarrow d$

5.  $S \rightarrow ASA \mid aB$   
 $A \rightarrow B \mid S$   
 $B \rightarrow b \mid \varepsilon$

6.  $S \rightarrow SS \mid (S) \mid \varepsilon$

Q. Convert the following CFG grammar into GNF

1.  $S \rightarrow ABb \mid a$   
 $A \rightarrow aaA \mid b$   
 $B \rightarrow bAb \mid bBB \mid ABB \mid a$

2.  $S \rightarrow AB$   
 $A \rightarrow BS \mid b$   
 $B \rightarrow SA \mid a$

3.  $E \rightarrow E + T \mid T$   
 $T \rightarrow T * F \mid F$   
 $F \rightarrow id \mid (E)$