

EXP-1
VLSI ENGINEERING
ANALOG
CMOS inverter

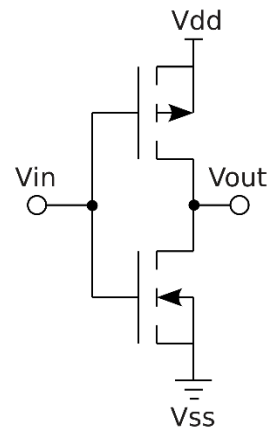
SWAGATA NASKAR
19EC3004

Aim :

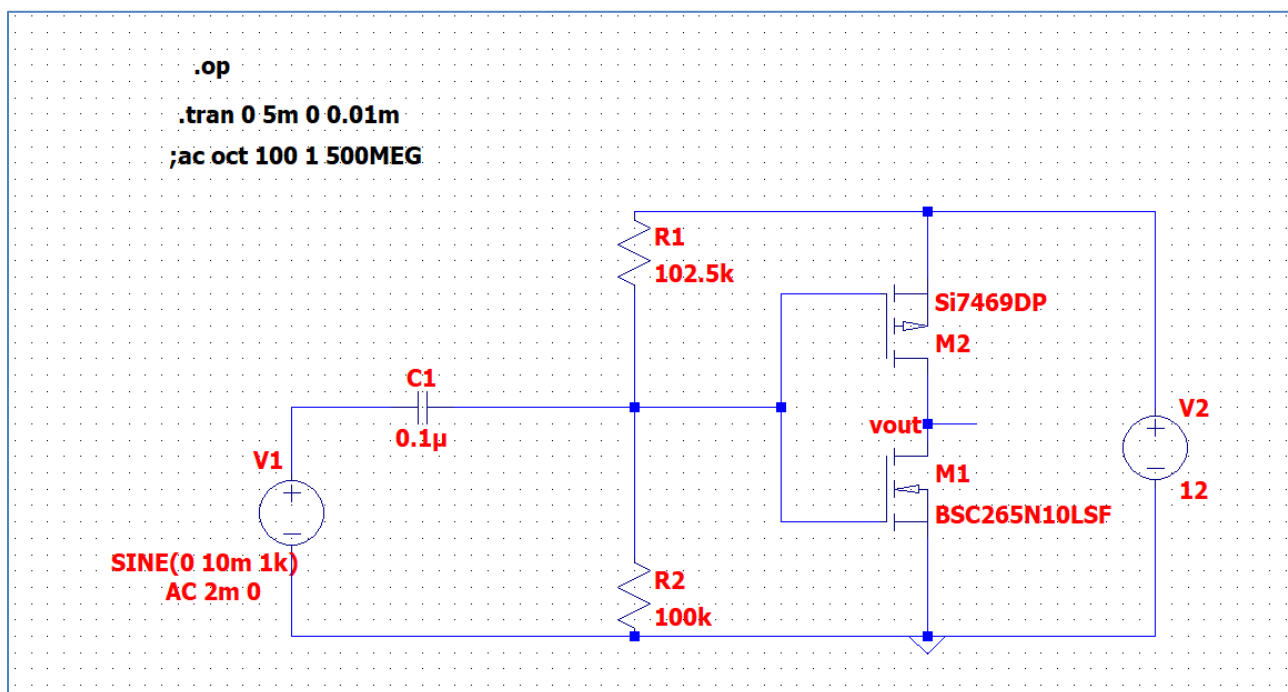
To design a CMOS inverter

Theory:

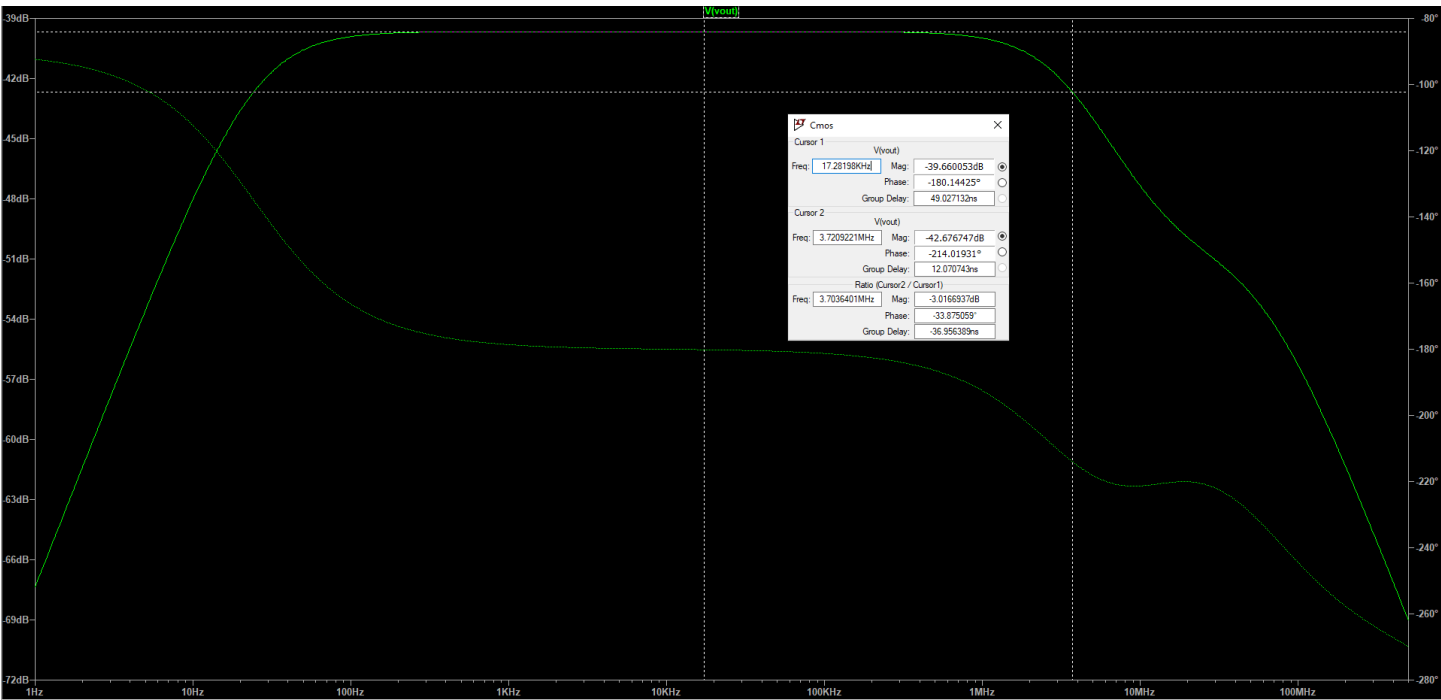
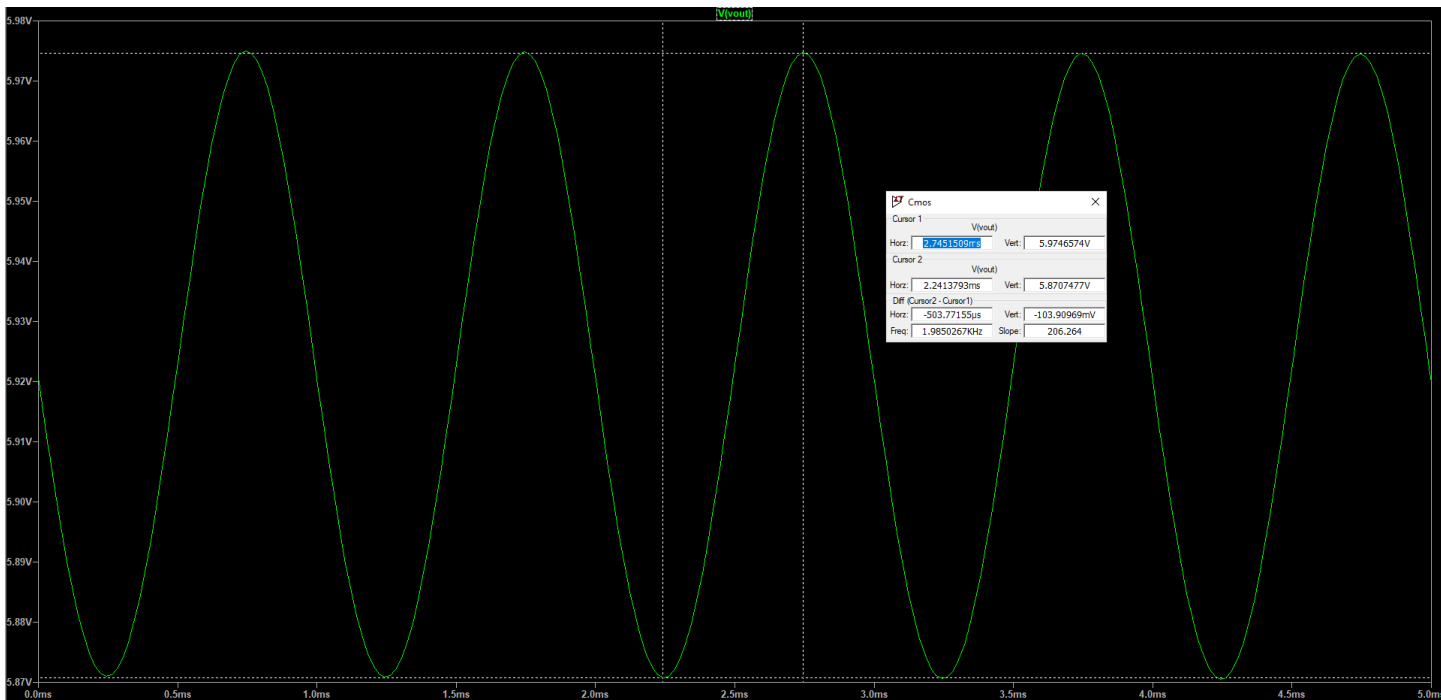
CMOS inverter definition is a device that is used to generate logic functions is known as CMOS inverter and is the essential component in all integrated circuits. A CMOS inverter is a FET (field effect transistor), composed of a metal gate that lies on top of oxygen's insulating layer on top of a semiconductor. These inverters are used in most electronic devices which are accountable for generating data on small circuits.



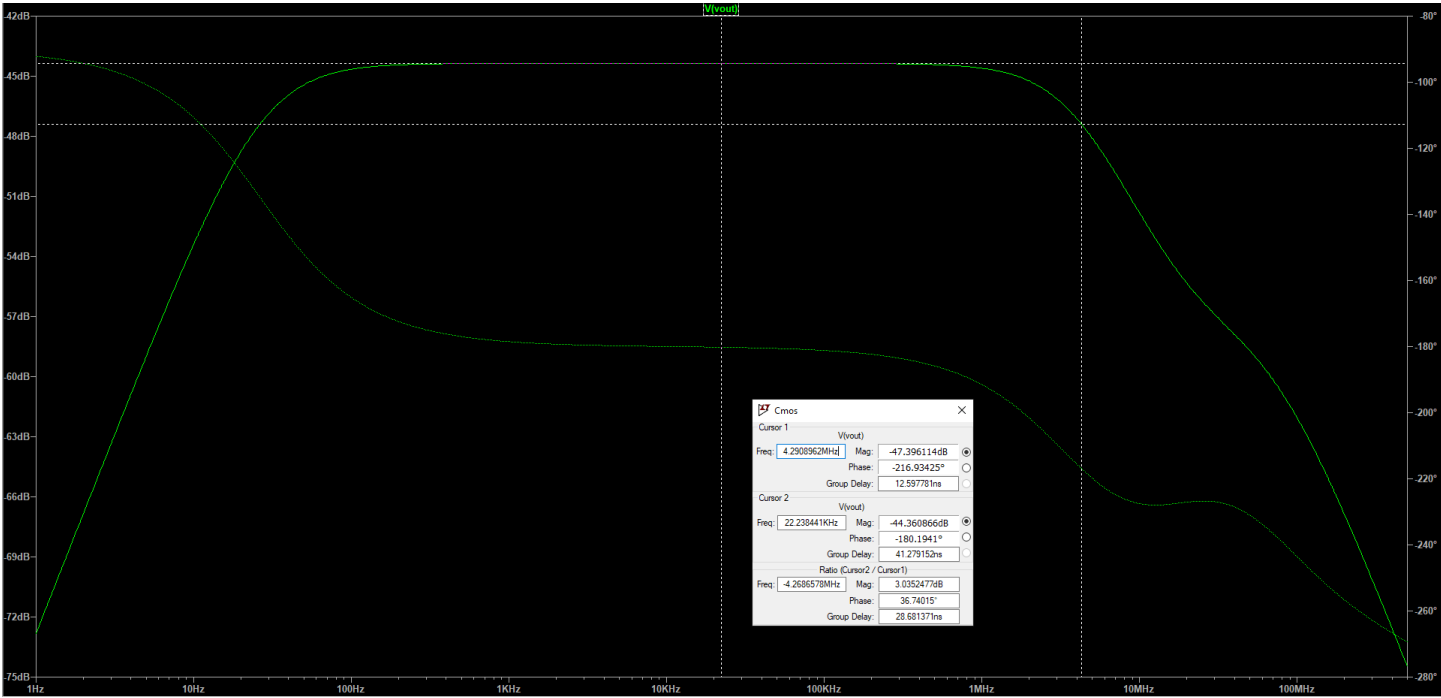
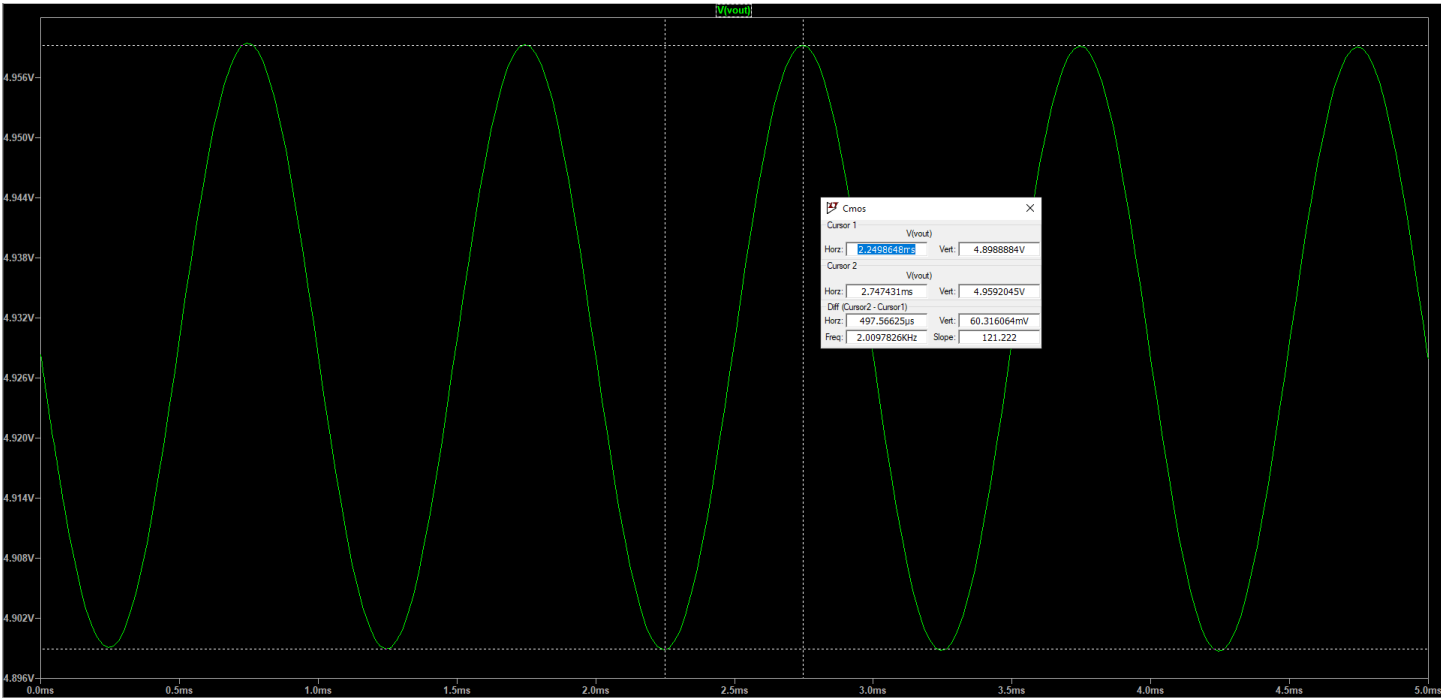
Circuit Diagram :



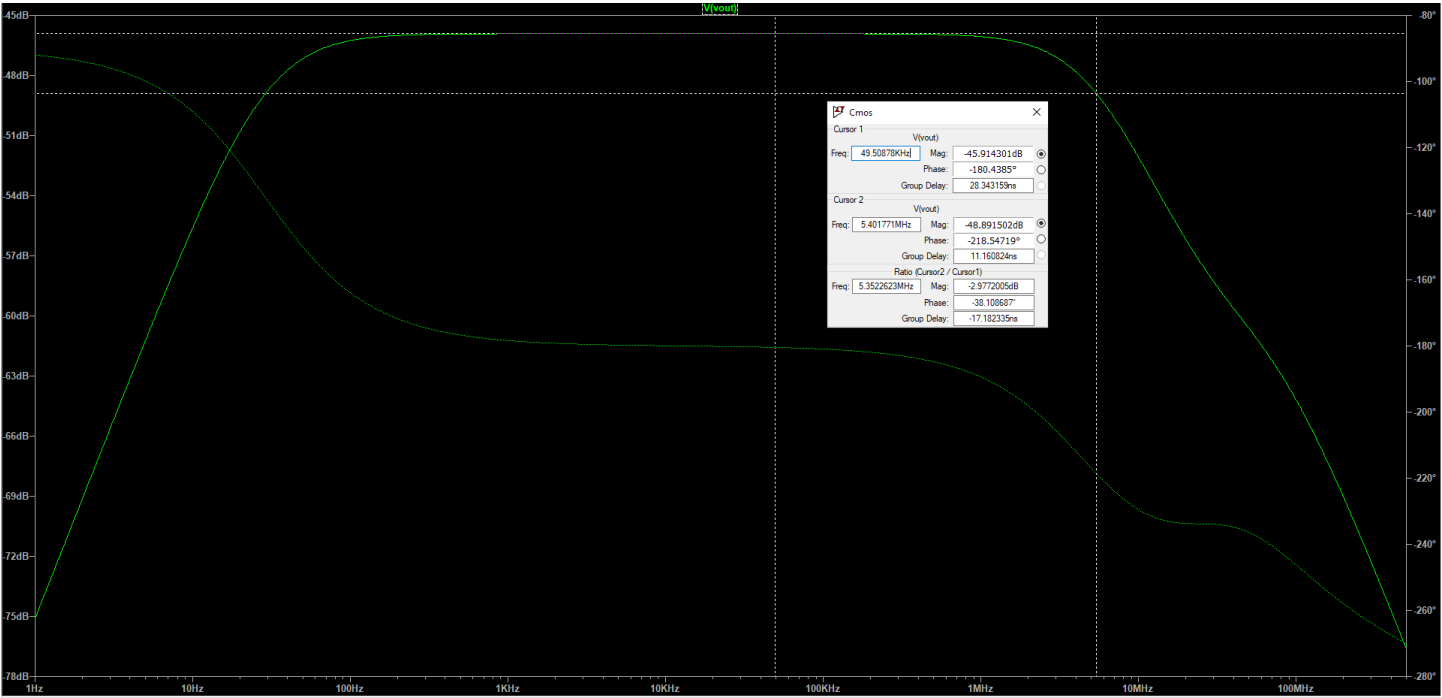
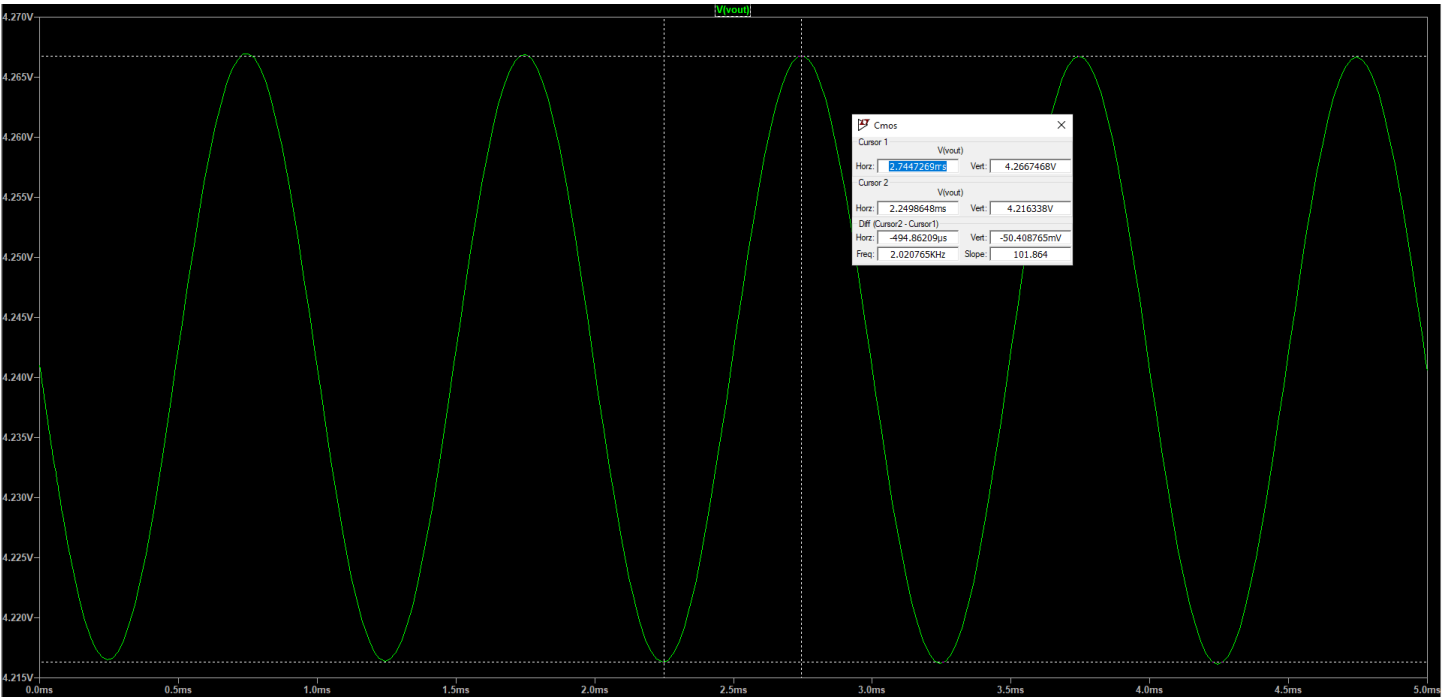
Observation:
For 12v
Graph :



For 8v :
graph



For 5v :
Graph :



Calculation :

Voltage for 12v

$R_1 = 102.5k$
 $R_2 = 100k$

$V_{out} = 5.92062$
 $V_{in} = 5.92593$

took 10m

Gain = $\frac{103.99143}{2 \times 10}$
 $= 5.19957$

Component

P-mos \rightarrow Si7469DP
N-mos \rightarrow BSC 265N10LSF

$(V_{th} = -2.5, K_p = 50)$
 $(V_{th} = 2.8, K_p = 49.2)$

~~1.9850267 kHz~~
freq = ~~1.9850267 kHz~~
 $|A_v| = 43.660117 \text{ dB}$

Voltage for 8v

$R_1 = 98.3k$
 $R_2 = 103k$

Gain $\rightarrow \frac{488.63868}{20}$
 $= 23.7314$

$V_{out} \rightarrow 4.19251$
 $V_{in} \rightarrow 4.09339$

$|A_v| = 29.219089 \text{ dB}$
freq = ~~2.0173913 kHz~~
 2.0173913 kHz

Voltage for 5v

$R_1 = 91.4k$
 $R_2 = 103k$

Gain $\rightarrow \frac{830.88276}{20}$
 $= 41.544138$

$V_{out} \rightarrow 2.96923$
 $V_{in} \rightarrow 2.64918$

$|A_v| = 24.723115 \text{ dB}$
freq = 2.0284153 kHz

Discussion:

- When the value of VDD will decrease then the value of gain will increase.
- When the Vdd changed from 12v to 8v then the gain bandwidth of CMOS will decrease.
- The gain value depends on the resistance used in the voltage divider part of the CMOS amp.