# EE210: Microelectronics-I

## Lecture-1 : Introduction

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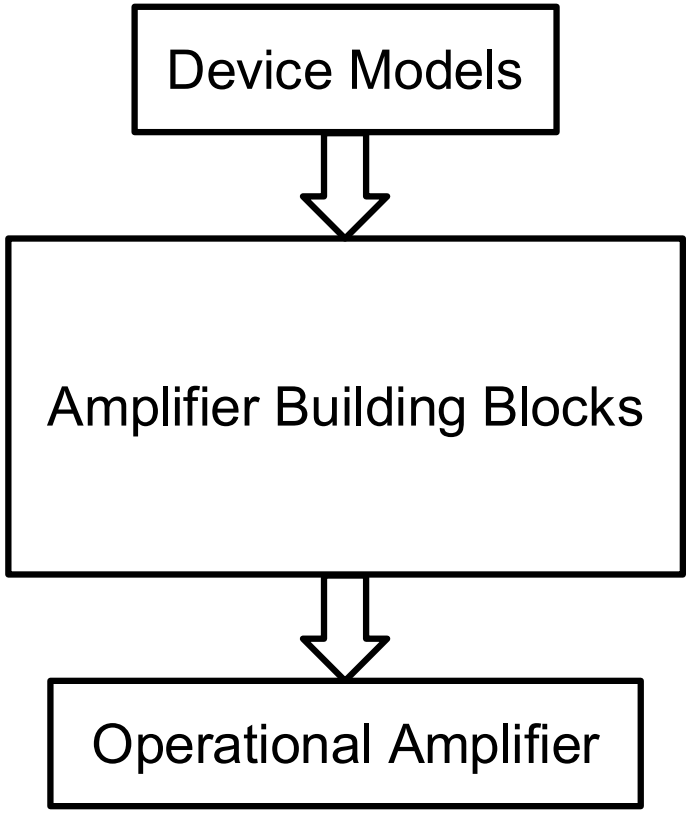
# EE210 is an Analog Circuits Course




Both BJT and MOS analog circuits will be studied

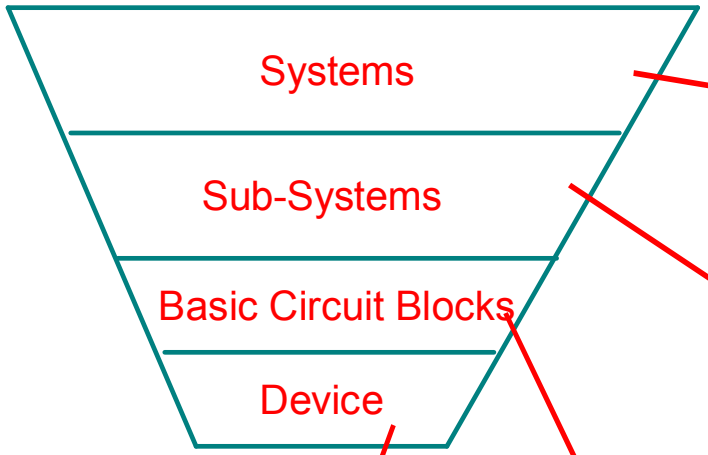
## Books :

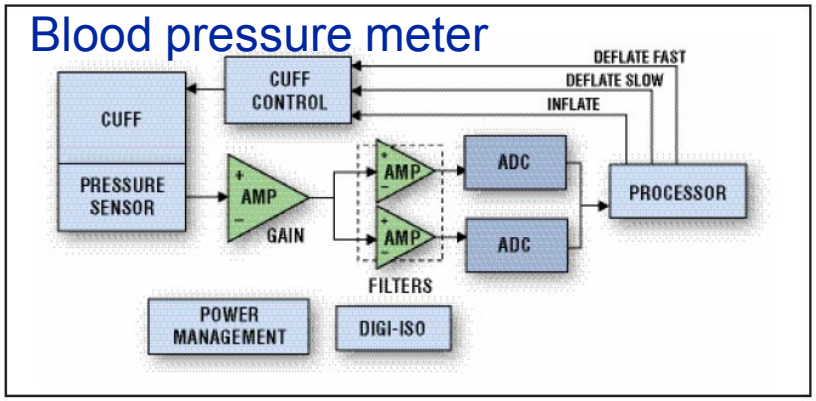

1. Semiconductor Devices and Circuits, A.K. Dutta, Oxford University Press India, 2008.
2. Analysis and Design of Analog Integrated Circuits; P.R. Gray, P.J. Hurst, S.H. Lewis, and R.G. Meyer; John Wiley & Sons, 4th Edition, 2001.
3. Microelectronic Circuits; A.S. Sedra and K.C. Smith; Oxford University Press, 4th Edition, 2000.
4. CMOS Analog Circuit Design, P.E. Allen and D.R. Holberg, Oxford University Press second Edition, 2002.
5. Design of Analog CMOS Integrated Circuits," B. Razavi, Tata McGraw Hill, 2002

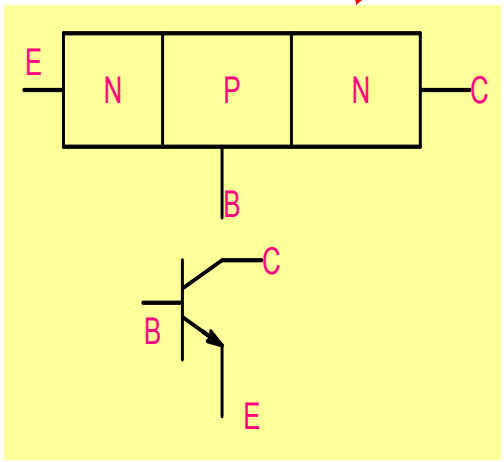

## Journals :

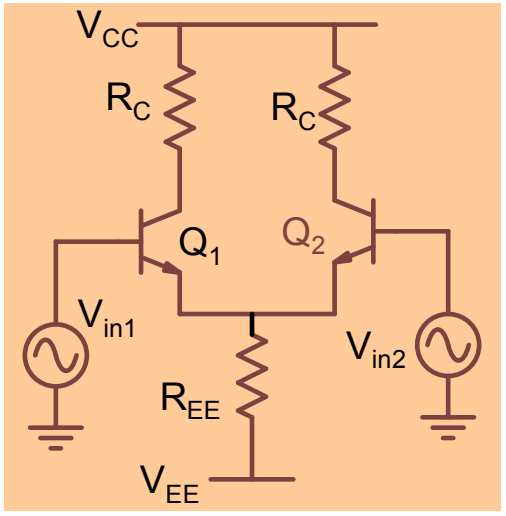

1. IEEE Journal of Solid state circuits
2. IEEE Trans. On Circuits and Systems
3. Analog Integrated Circuits and Signal Processing, springer.

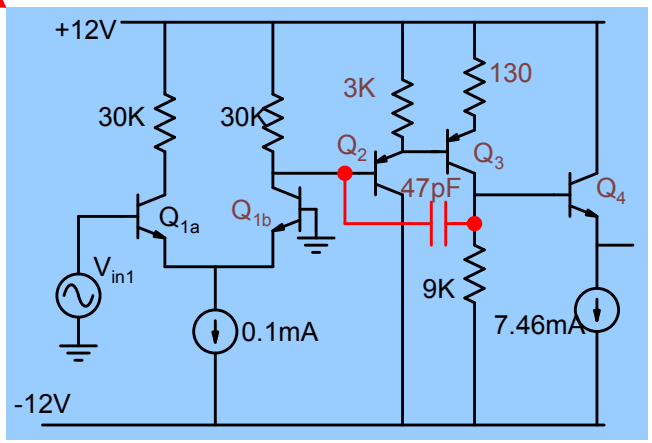

Lecture notes (from previous years) :
https://www.youtube.com/channel/UCHJ-zINlZnOh3UQMo1lcuZw


Systems
Sub-Systems
Basic Circuit Blocks
Device

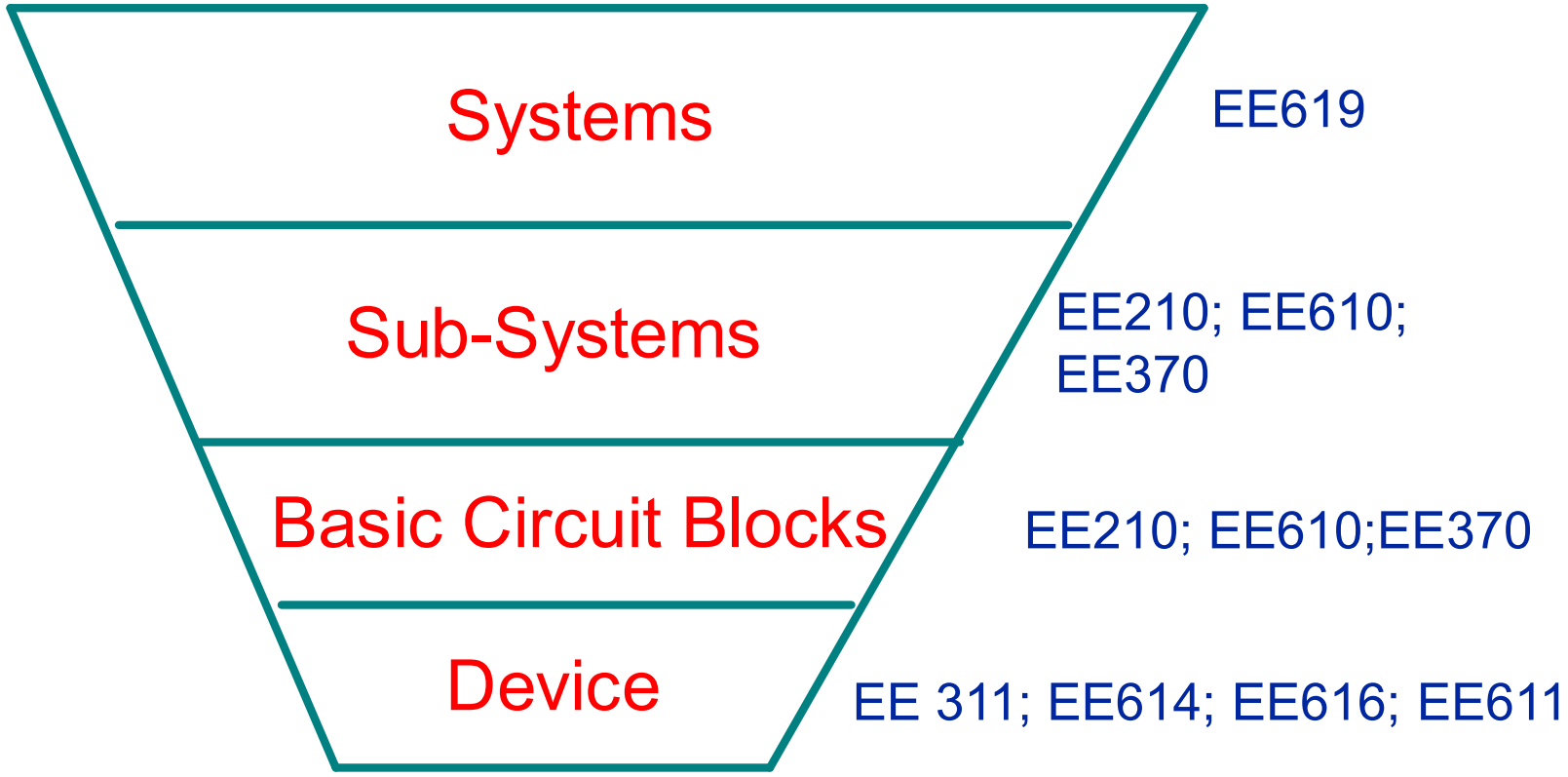

Blood pressure meter
CUFF
CUFF CONTROL
DEFLATE FAST
DEFLATE SLOW
INFLATE
PRESSURE SENSOR
AMP
GAIN
AMP
AMP
FILTERS
ADC
ADC
PROCESSOR
POWER MANAGEMENT
DIGI-ISO


E
N
P
N
C
B
C
B
E


$V_{CC}$
$R_C$
$R_C$
$Q_1$
$Q_2$
$V_{in1}$
$V_{in2}$
$R_{EE}$
$V_{EE}$


+12V
30K
30K
3K
130
$Q_2$
$Q_3$
47pF
$Q_4$
$Q_{1a}$
$Q_{1b}$
$V_{in1}$
9K
0.1mA
7.46mA
-12V

# Microelectronics : Courses

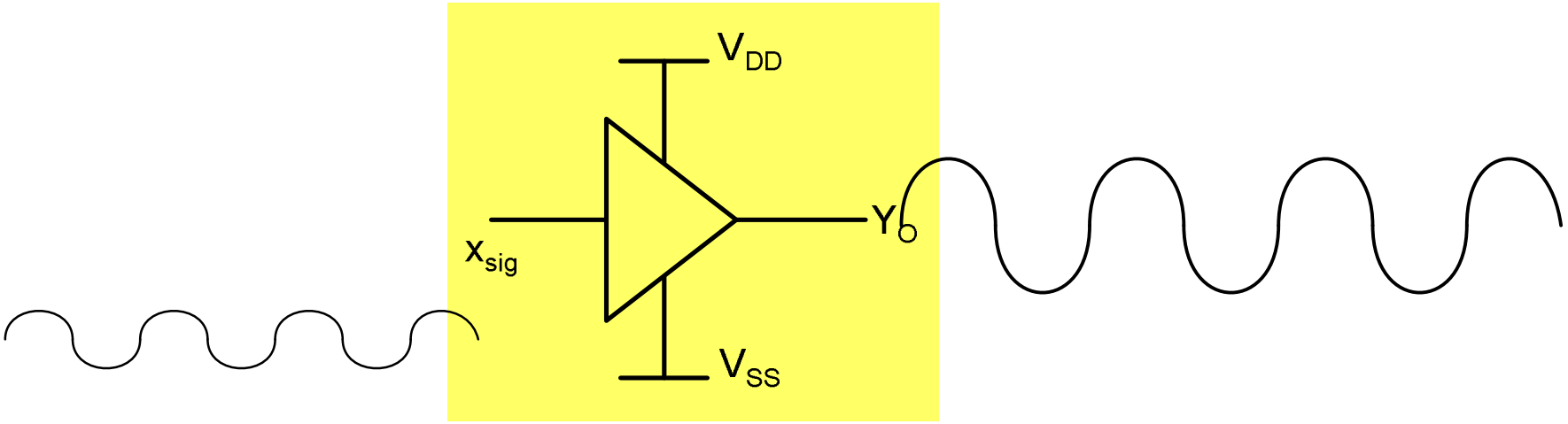


# What is Microelectronics?

It is a field which deals with implementation of ‘ideas’ on a piece of semiconductor (e.g. Silicon)

Microelectronics is ‘Writing in Sand’

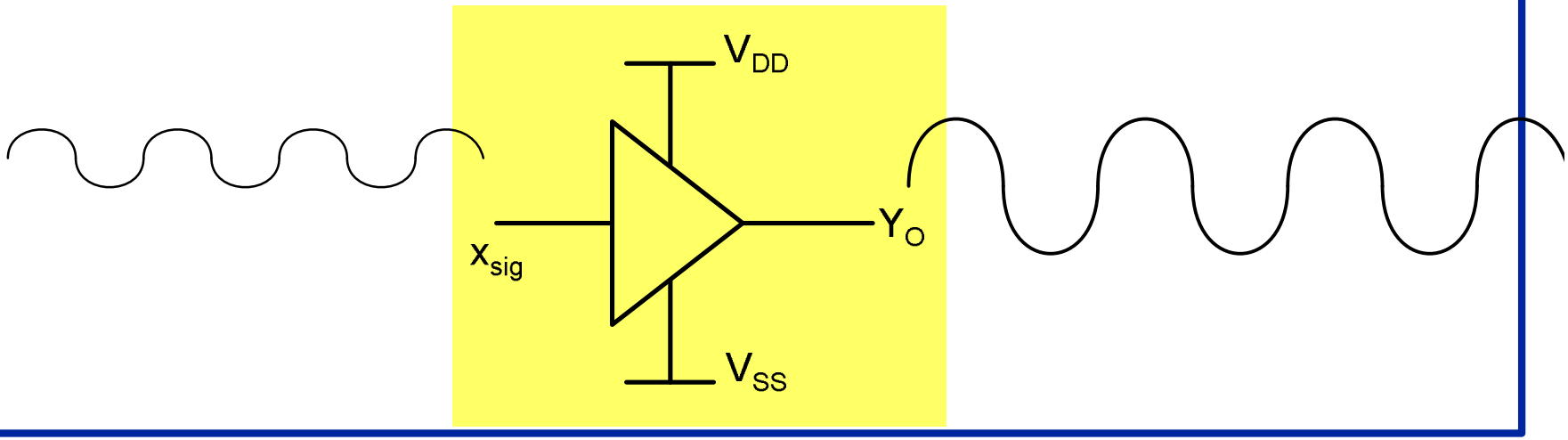
# EE 210 is a Course on Amplifiers



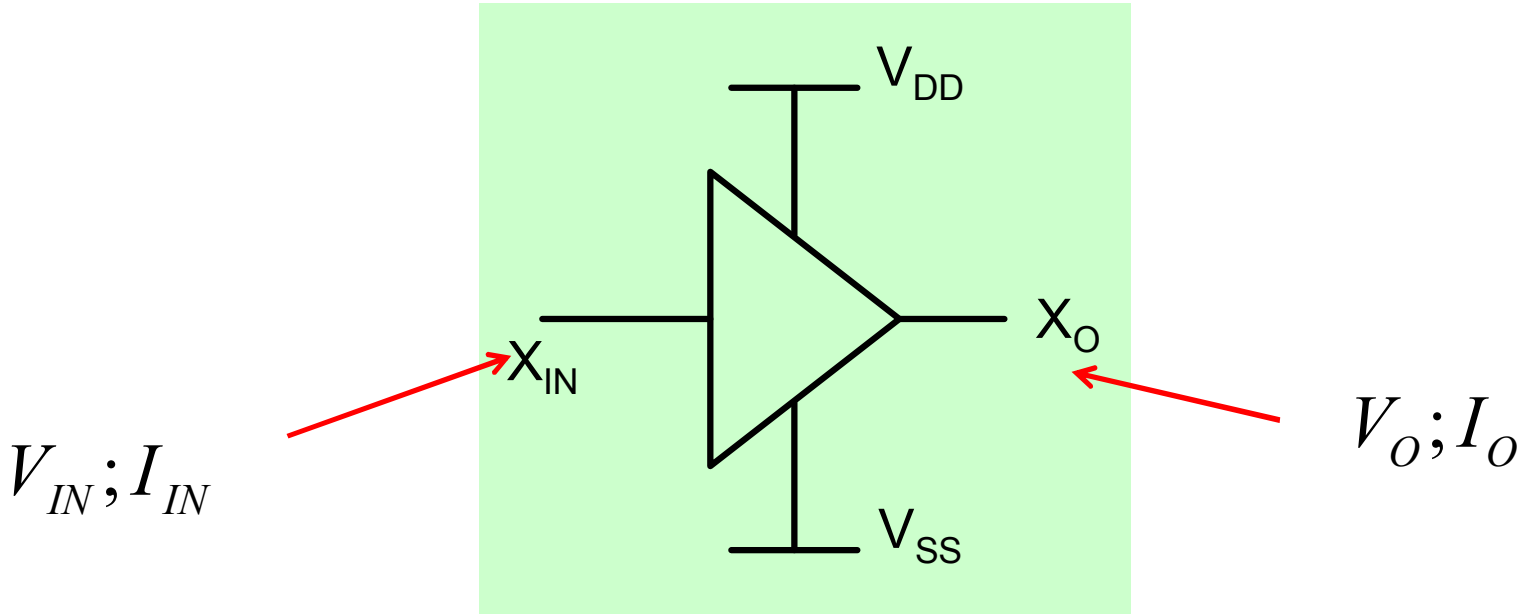

$$\frac{P_O}{P_{sig}} > 1$$

"Amplification is the heartbeat of Electronics"

# The foundation of civilization is “Amplification”

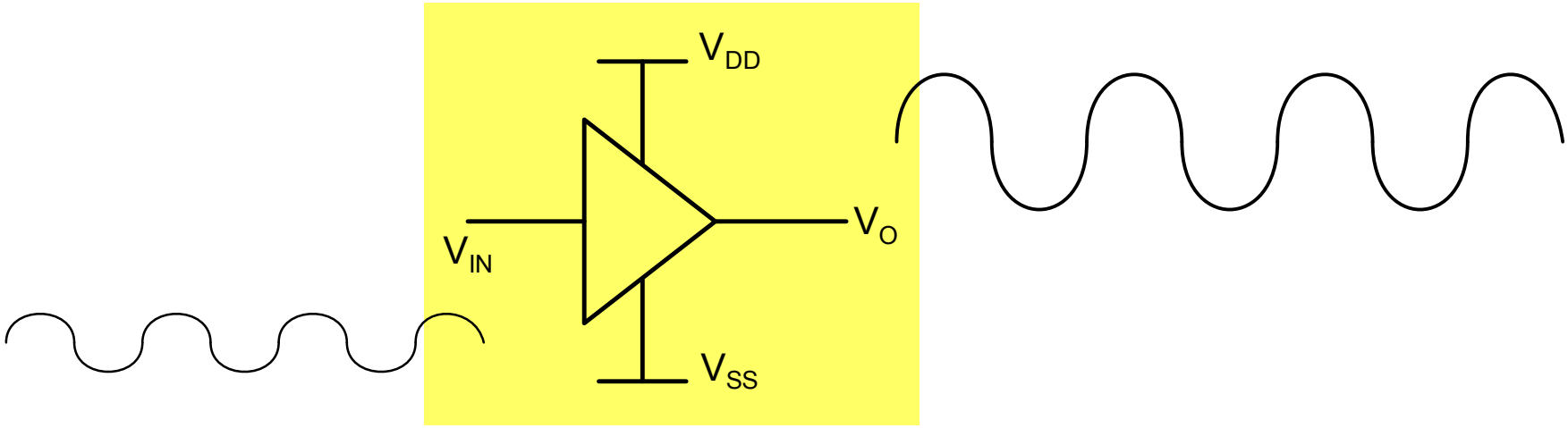


Depending on the input and output, there can be four broad classes of amplifiers




| INPUT | OUTPUT | Amplifier |
|---|---|---|
| V | V | Voltage |
| V | I | Transconductance |
| I | I | Current |
| I | V | Transresistance |

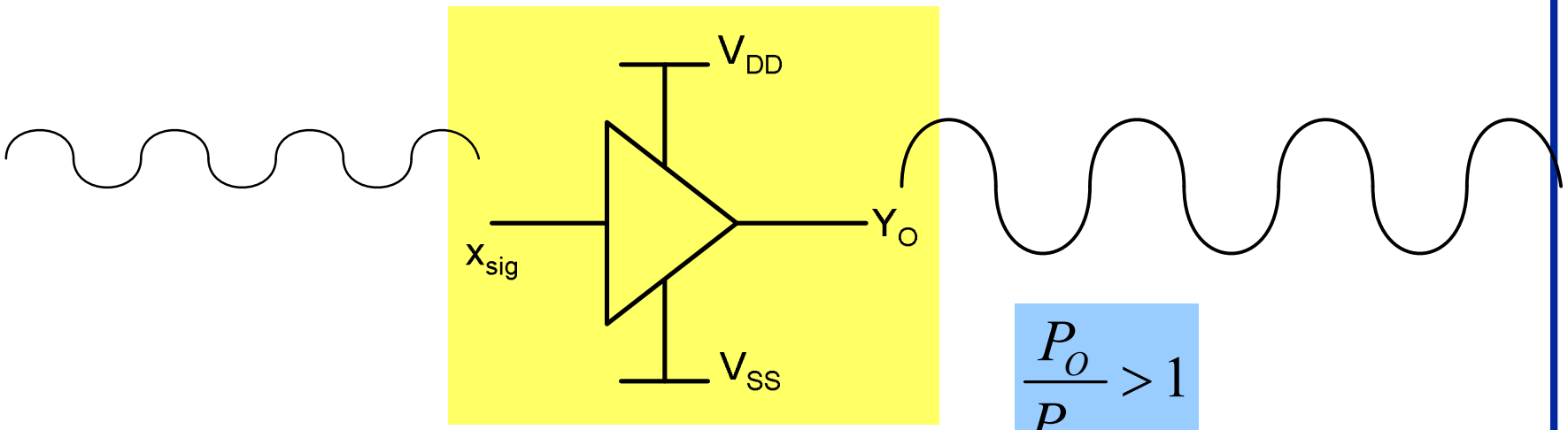
# Ideal Voltage Amplifier



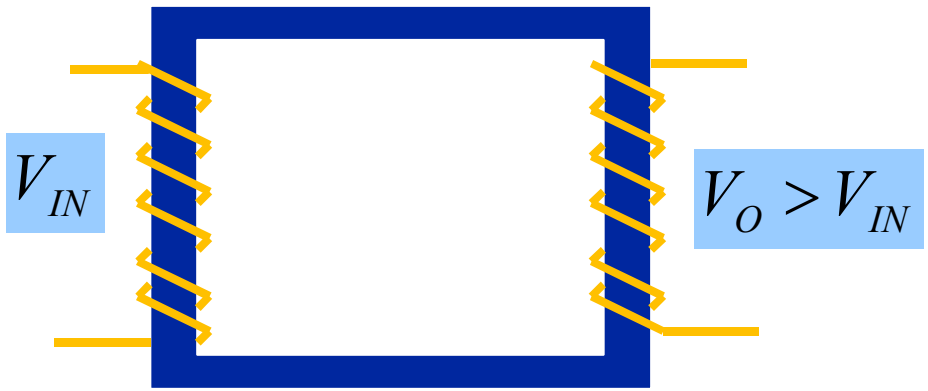

$$V_O = A_v \times V_{IN}$$

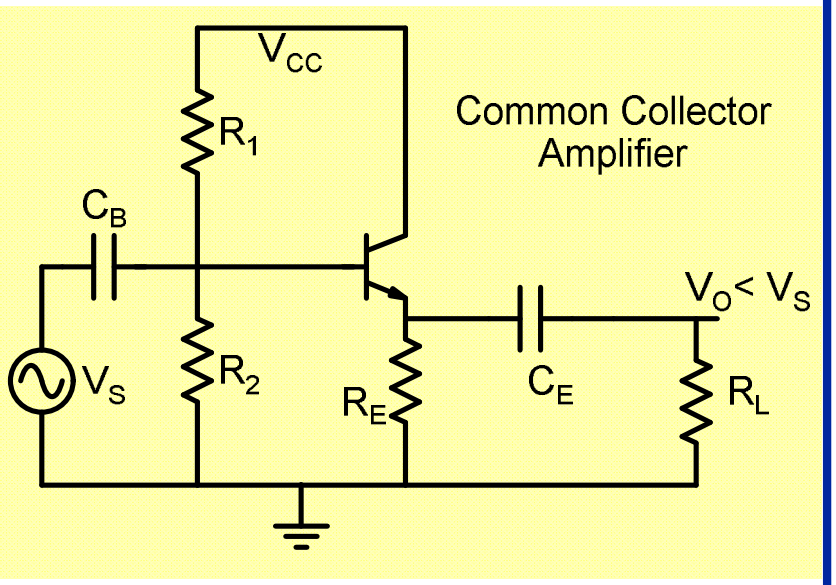
**$A_v$ is a constant**

Should $A_v$ be >1 ?



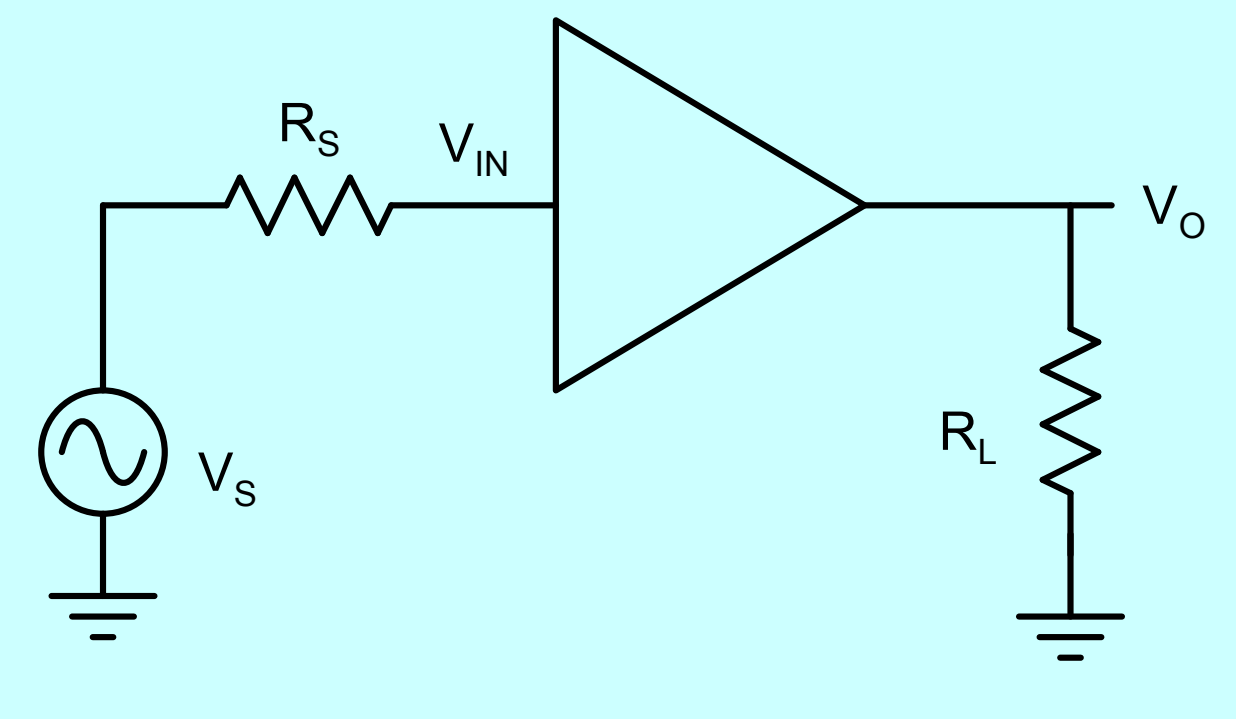

$$\frac{P_O}{P_{sig}} > 1$$



# Practical Amplifier

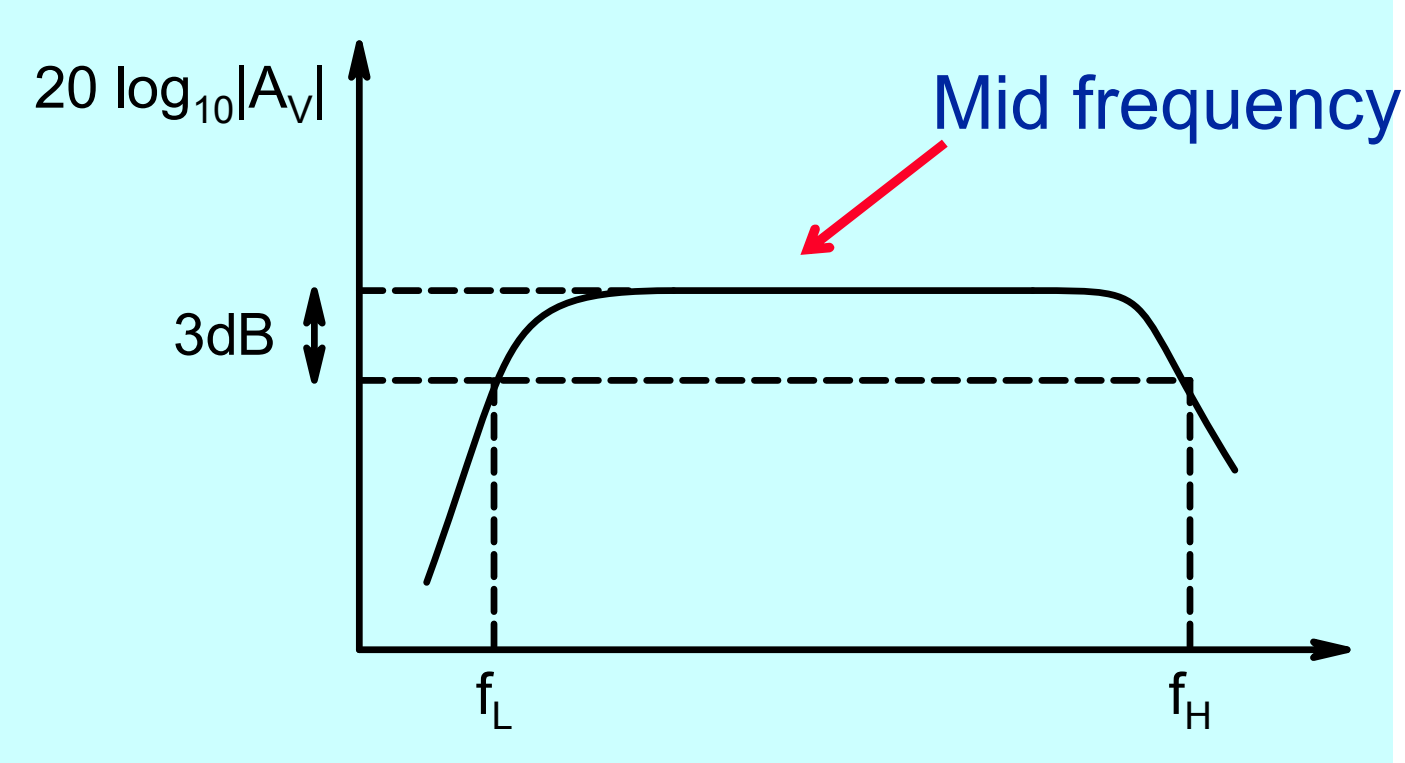
Ideal: $V_O = A_v \times V_{IN}$



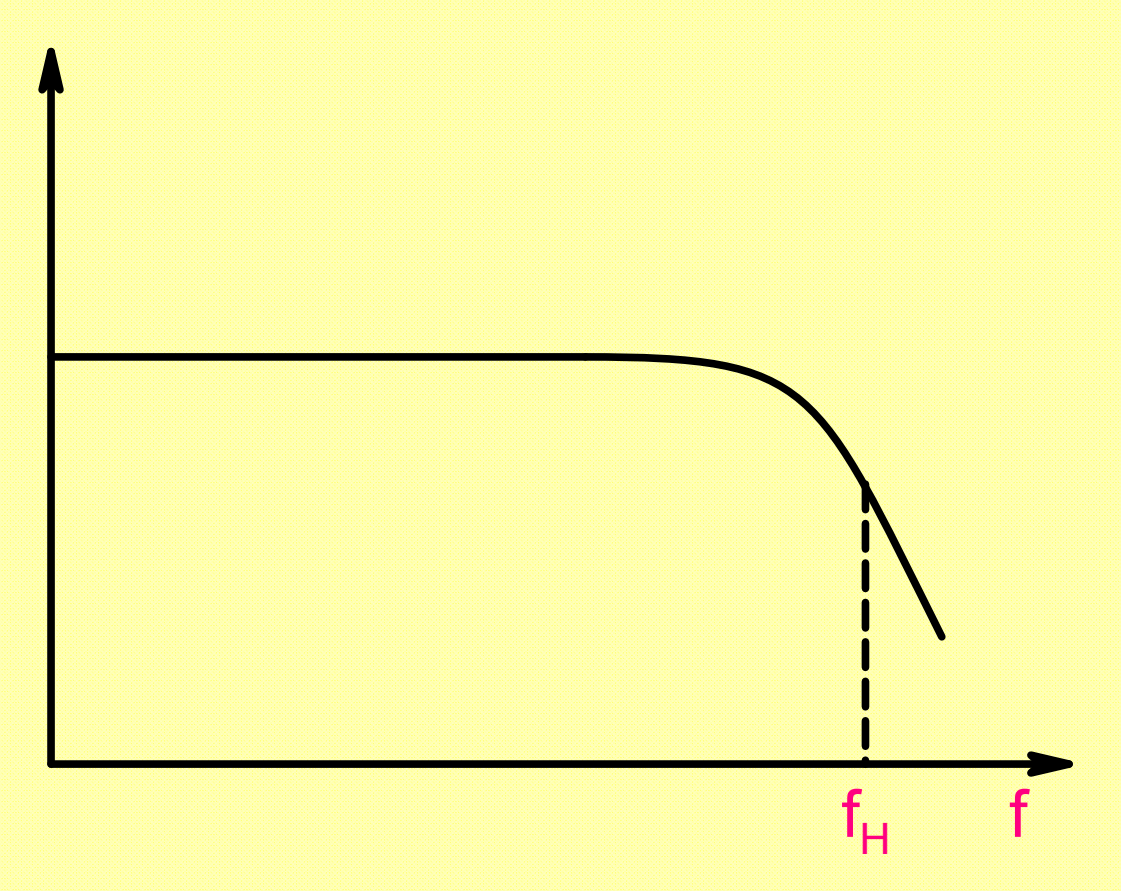

$$V_o = A_v(f, V_{in}, R_L, R_S, T) \times v_{in} + \tilde{e}_N$$

# Frequency Response

$$V_o = A_v(f, V_{in}, R_L, R_S, T) \times v_{in} + \tilde{e}_N$$



# dc Amplifier



# Unity Gain Frequency