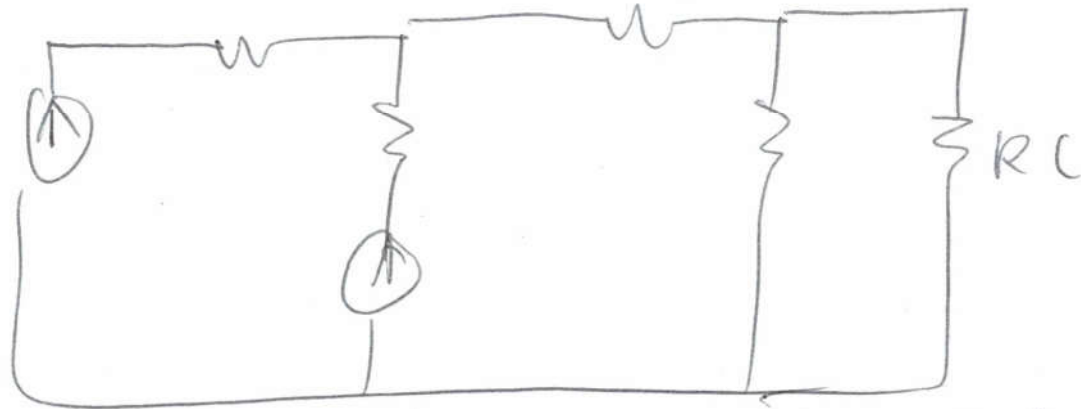


Final Exam Review

- ① Thevenin / NORTON / superposition / RC filters
- ② Diode / opAmp (symbol)
- ③ CMOS
- ④ BJTs

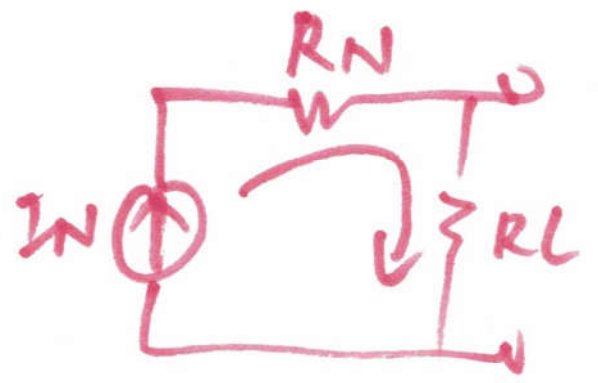
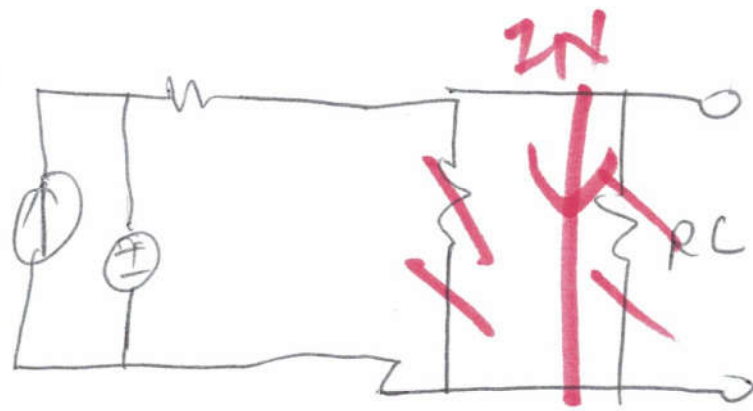


Thevenin
Remove R_L
Remove current source
short voltage source

R_{TH}

Remove R_L .
Voltage at the output.

V_{TH}

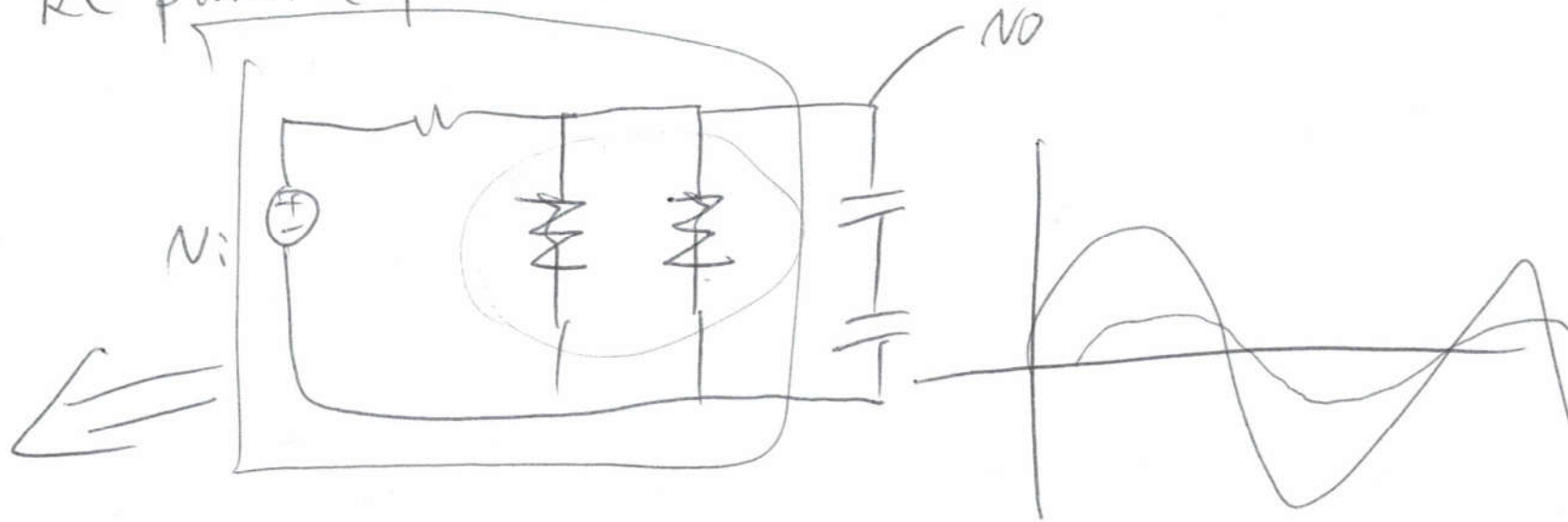


Norton:

R_N {
 Remove R_L
 Remove current source
 Short voltage source

I_N {
 Short R_L .
 The current flows through the output

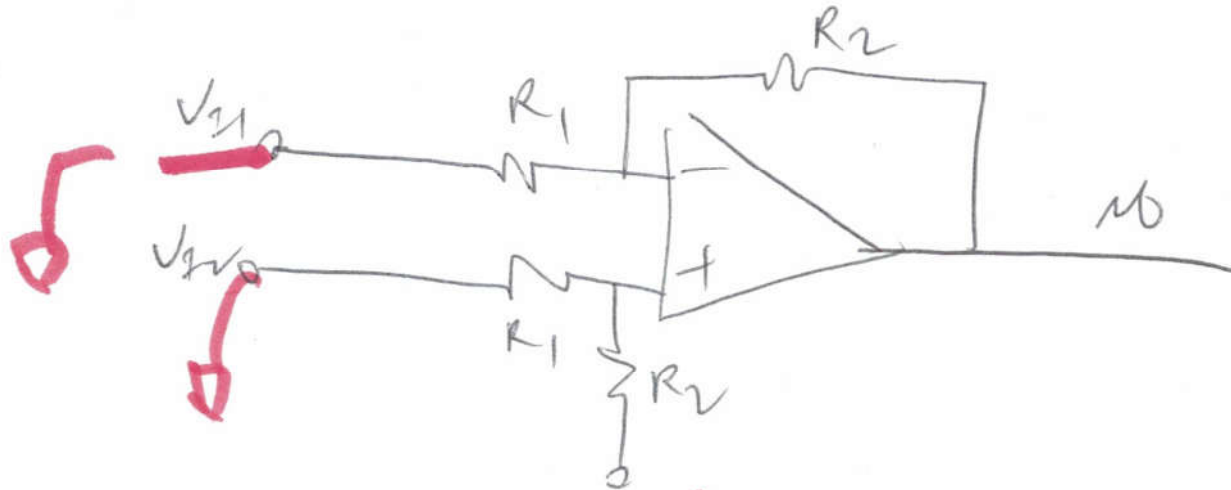
RC passive filters:



Op Amp

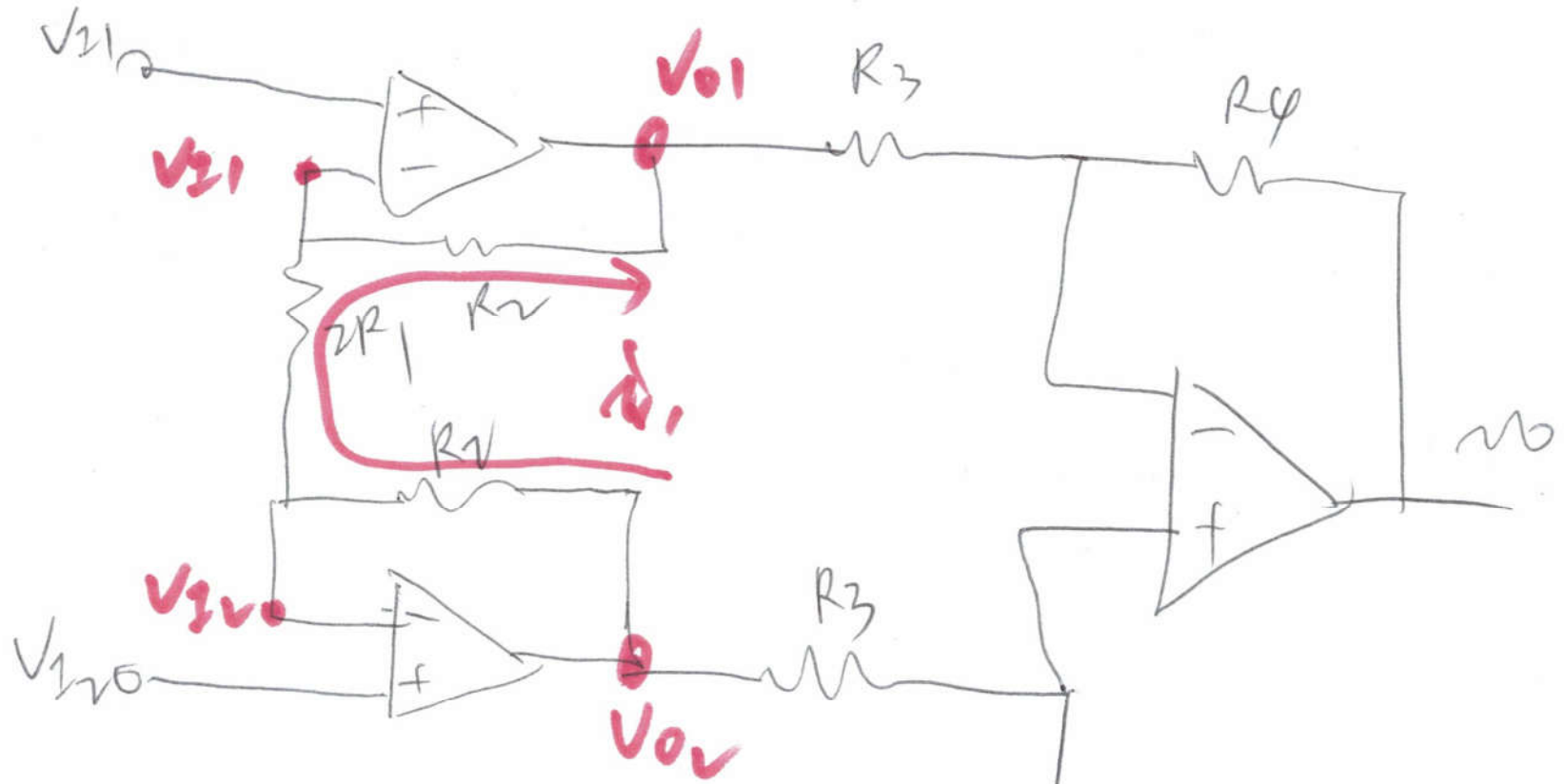
Difference Amplifier

Differential Gain / Common-mode Gain.



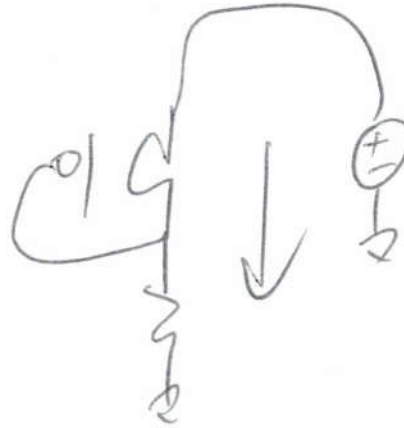
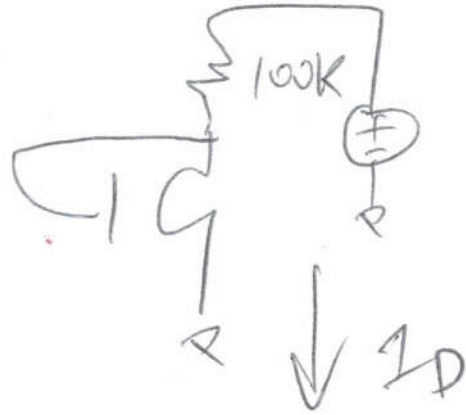
Superposition.

Instrumentation Amplifier.

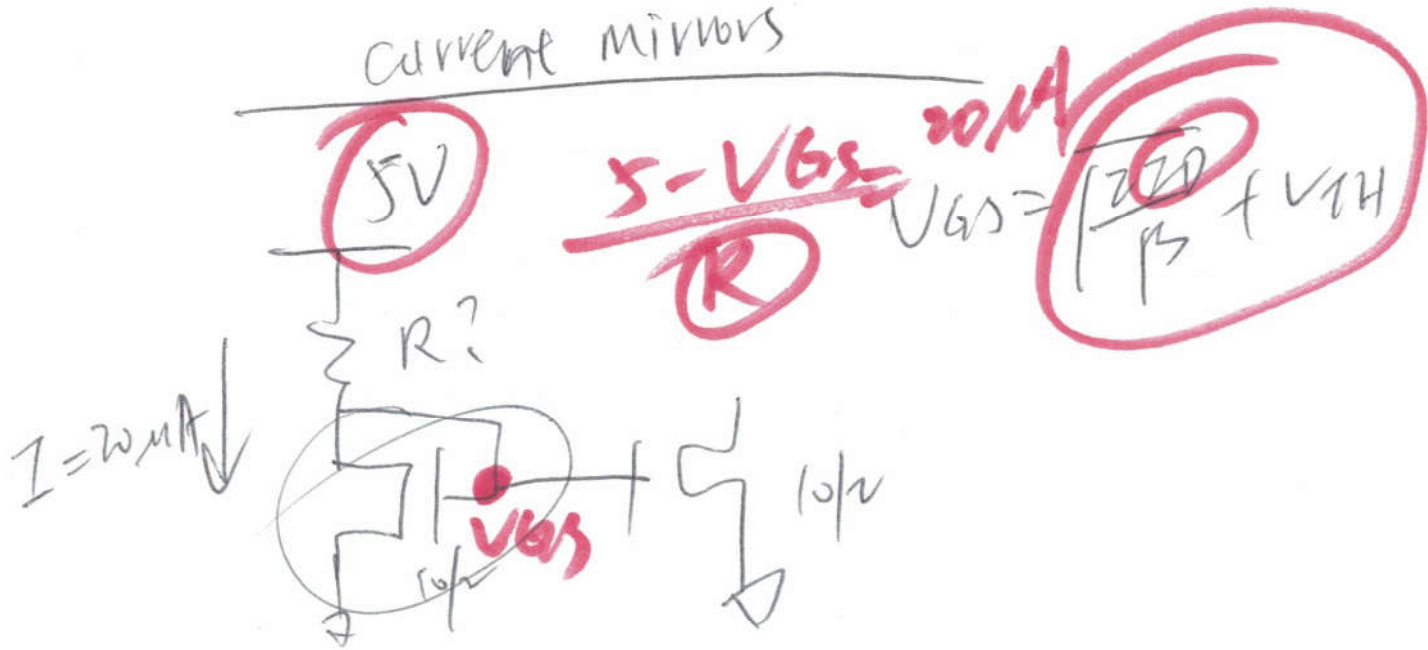


$$\begin{aligned}
 i &= \frac{V_{02} - V_{01}}{R_2} = \frac{V_2 - V_1}{R_2} \\
 i &= \frac{V_2 - V_1}{2R_1}
 \end{aligned}$$

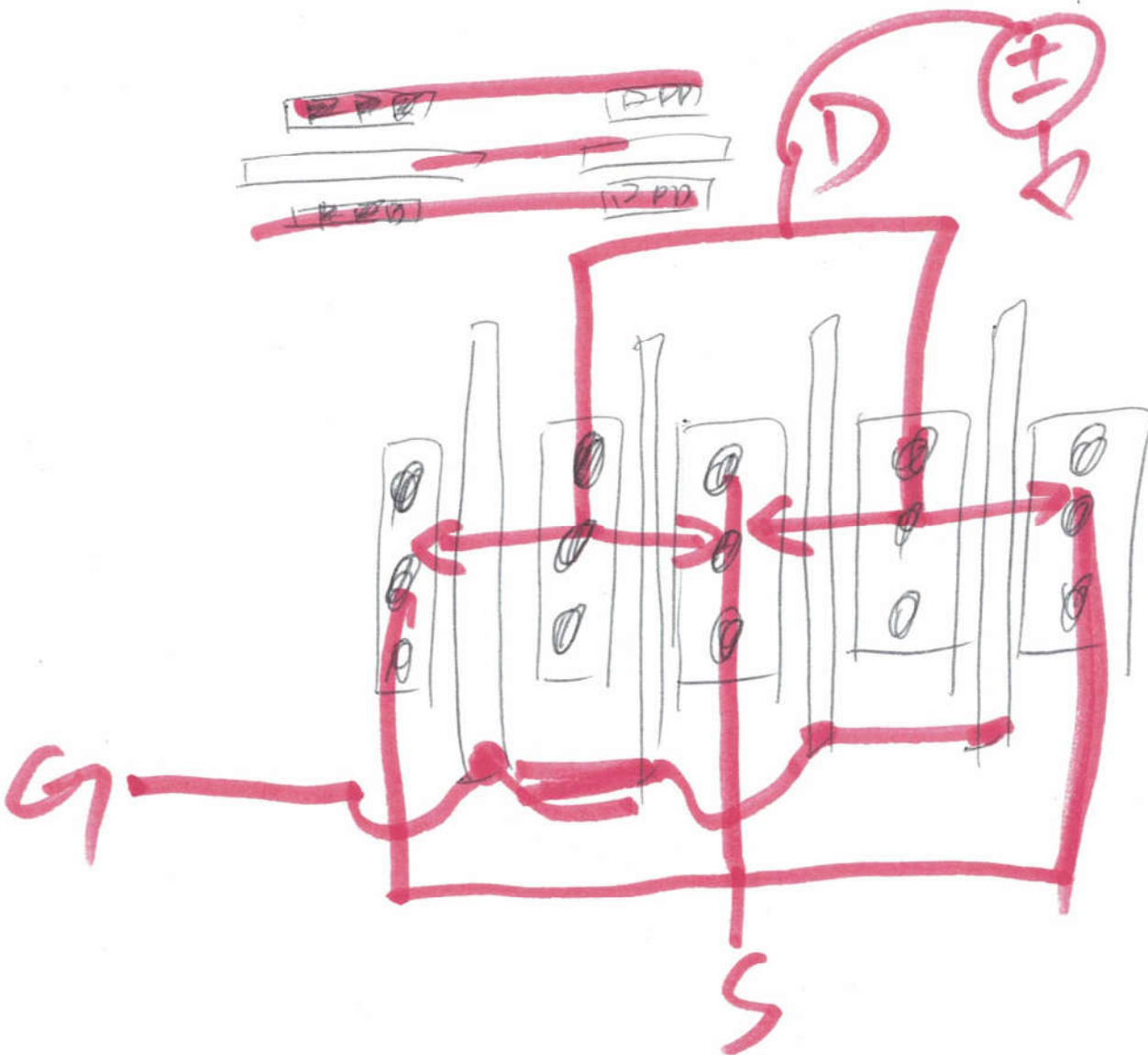
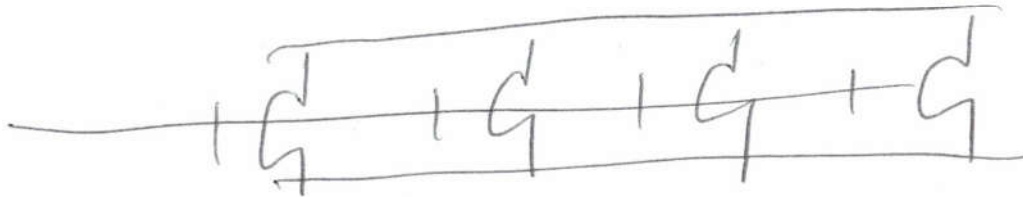
CMOS



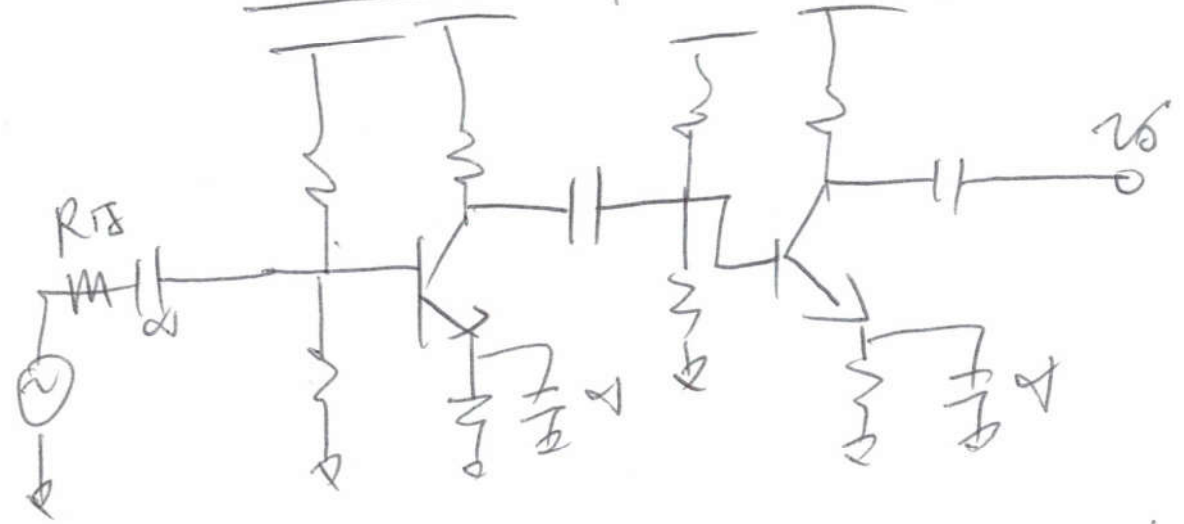
Current Mirrors



Layout



BJTs



DC: $A_{v_{DC}}$ gain Hybrid- π model?

90 min Exam