ECE 110 Final Exam Review Session

COREY SNYDER

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Before we get started…

- We have additional office hours this week
- Don't forget about HKN
- You get a cheat sheet!
  - 1 8.5x11" two-sided

	8-Dec	9-Dec	10-Dec	11-Dec	12-Dec	13-Dec	14-Dec	15-Dec
9am-10am	Prof. Gruev	Prof. Gruev						Nauman Qureshi
10am-11am	Prof. Chen	Prof. Chen			Maddie Wilson			Nauman Qureshi
11am-12pm			Maddie Wilson	Corey Snyder	Maddie Wilson	Ari Loundy		
12pm-1pm			Maddie Wilson	Corey Snyder		Ari Loundy	Corey Snyder	Lian Yu
1pm-2pm							Prof. Choi	Lian Yu
2pm-3pm						Prof. Schmitz	Prof. Schmitz	
3pm-4pm	Oscar Bi		Ari Loundy		Prof. Choi	Oscar Bi		
4pm-5pm	Oscar Bi	Oscar Bi	Ari Loundy	Steven K.	Oscar Bi		Steven K.	
5pm-6pm		Steven K.		Steven K.				

Circuit Analysis Basics

- Ohm's Law: V = IR
- Kirchhoff's Voltage Law (KVL):
  - Sum of voltage rises = Sum of voltage drops in a closed loop
- Kirchhoff's Current Law (KCL):
  - Sum of currents entering the node = Sum of currents exiting the node
- Resistors in series versus resistors in parallel
  - Series -> Same current
  - Parallel -> Same node voltages

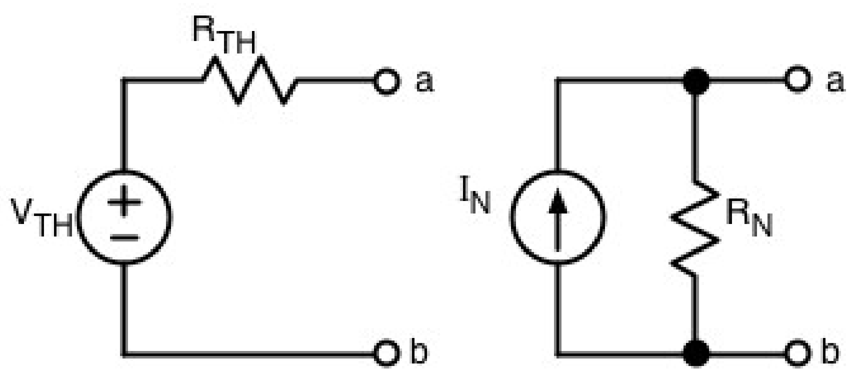
Power and Labeling

- P = IV
  - Can find other forms using Ohm's Law
- With standard labeling, current goes from + to –
  - P = IV
  - V = IR
- With non-standard labeling, current goes from – to +
  - P = -IV
  - V = -IR

Thevenin and Norton Equivalents

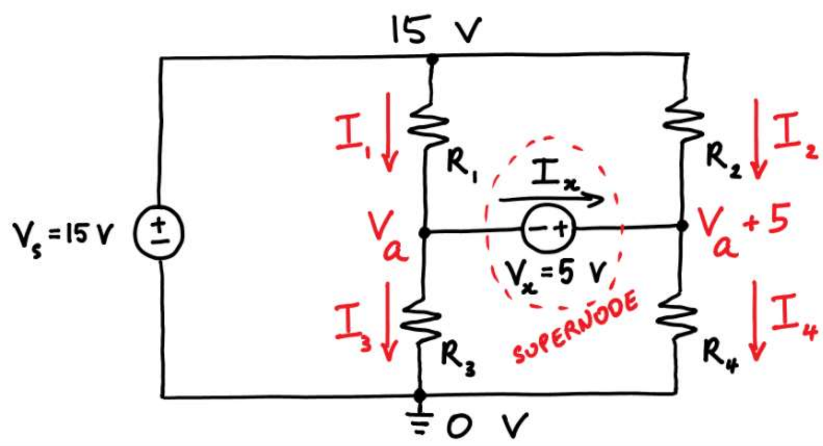
- Three parameters to figure out
  - $I_N = I_{SC}$
  - $V_T = V_{OC}$
  - $R_T = R_T = R_{eff}$

- $I = \frac{-I_{SC}}{V_{OC}} V + I_{SC} = \frac{-V}{R_T} + I_{SC}$
- Load Line



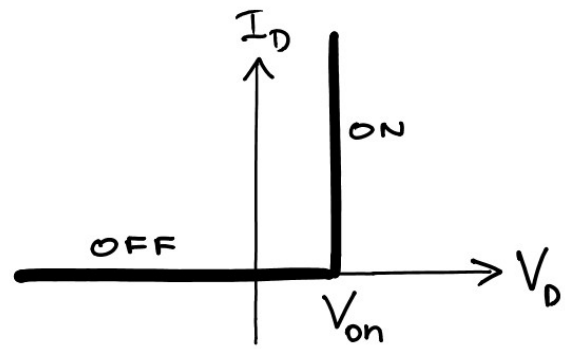
Node Voltage Method

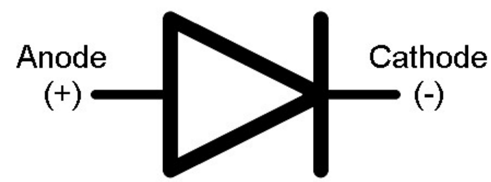
- Combination of KCL and Ohm's Law
- Be careful of current directions
- Utilize supernode when there is a floating voltage source



Diodes and their Applications

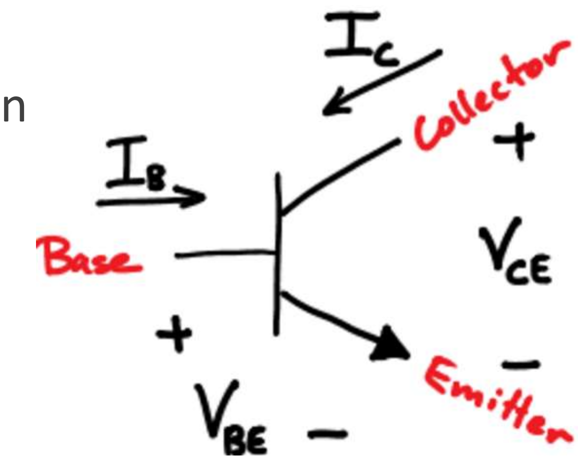
- Remember the basic operation of a diode
  - Large-Signal Model
- Rectifiers
  - Used in AC/DC converters (ECE 343!)
- Clipper circuits
  - Useful to check extreme values for input





Bipolar Junction Transistor (BJT)

- Three terminal device: Base, collector, emitter
- $V_{BE,ON}$ and $V_{CE,SAT}$ are properties of the BJT (ECE 340!)
- In ECE 110 we consider the Common-Emitter (CE) configuration
  - For more on this, take ECE 342!
- Three regions of operation: Off (Cutoff), Active, Saturation
- Off: $V_{BE} < V_{BE,ON}$, all currents are zero!
- Active: $V_{BE} > V_{BE,ON}$, $I_C = \beta I_B$
- Saturation: $V_{BE} > V_{BE,ON}$, $V_{CE} = V_{CE,SAT}$, $I_C \neq \beta I_B$!



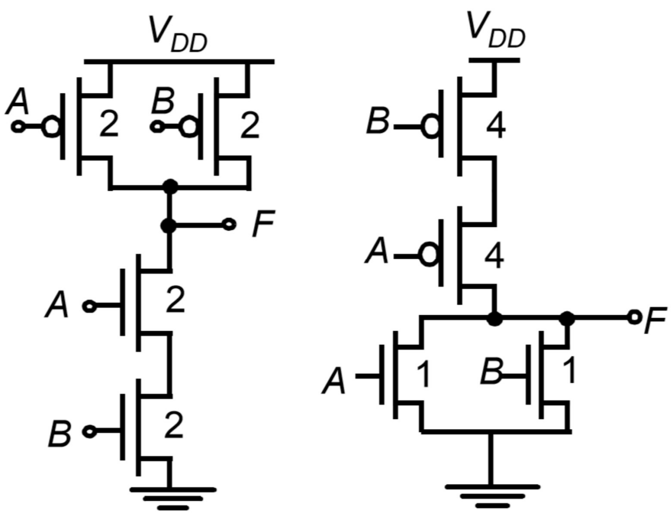
Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET)

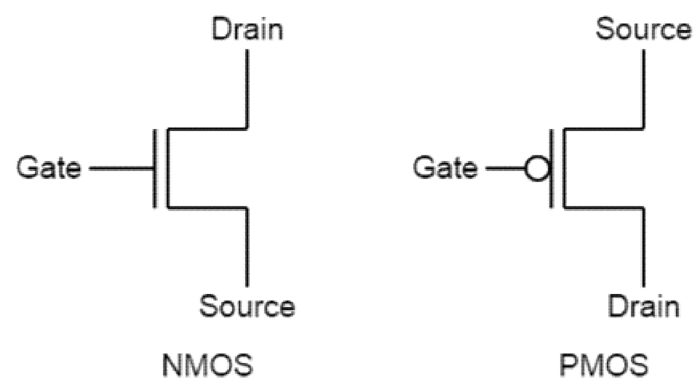
- Three terminal device: gate, source, drain
- Comes in two flavors, NMOS and PMOS, more on this in the next slide!
- V_{TH} is a property of the specific MOSFET (hello again ECE 340)
- Be comfortable interpreting I-V Characteristic of MOSFET

Conditions	Mode	Behavior under Linear Model
$V_{GS} < V_{TH}$	OFF	$I_D = 0$
$V_{GS} > V_{TH}$ $V_{DS} > V_{GS} - V_{TH}$	ACTIVE	$I_D = k(V_{GS} - V_{TH})^2$
$V_{GS} > V_{TH}$ $V_{DS} < V_{GS} - V_{TH}$	OHMIC	$I_D = k(V_{GS} - V_{TH})V_{DS}$

Complementary MOS Logic (cMOS)

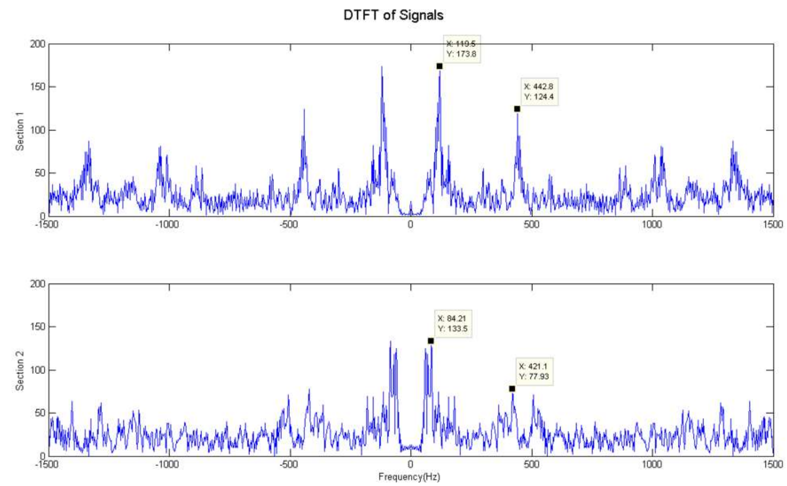
- Combine NMOS and PMOS transistors in order to perform a logical operation
  - i.e. AND, NOR, NOT
- NMOS and PMOS are biased differently
  - NMOS, source connects to ground; PMOS, source connects to V_{DD}





Intro to Digital Signal Processing

- Sampling
  - Nyquist Criterion
    - $f_s > 2f_{max}$
- Quantization
  - Can encode 2^N levels for N bits
  - Round to nearest level
- Data Conversion
  - Amount of data in a song, etc.
- Take ECE 310!



Compression and Huffman Encoding

- $\frac{original\ data\ rate}{compressed\ data\ rate}$
- Savings = 1 – 1/DCR
- Huffman Encoding
  1. Pick two least frequent elements
  2. Pair these elements, pick a standard (bigger on the left or right)
  3. Eliminate paired elements, replace with new combined node
  4. Repeat 1-4 until you reach root node (sum is 1)
  5. Label left branches 1's, right branches 0's (technically the opposite works too, again be consistent!)

Legit Tips and Tricks to Show Off Your Wits

Concise Advice to Make Your Grade Look Nice

Wise Words to Make your Score Soar

Lessons to Lend to a Friend for the End (of the semester)

- Use your study sheet more like a study tool
- Don't spend too much time on questions you can't do
- Spend your time showing what you know
- Pace yourself, you have three hours!
- Take some time to relax before the exam