HKN ECE 110 Review Session
Exam 3

COREY SNYDER
STEVEN KOLACZKOWSKI
Reminders

• You are allowed one 8.5x11” note sheet (two-sided)

• Additional office hours help

• Course staff applications

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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</thead>
<tbody>
<tr>
<td>9</td>
<td>All office hours are held in 1005 ECEB unless otherwise indicated. NAMES IN RED, EXAM WEEKS ONLY!</td>
<td>PROF. GRUEV</td>
<td>NOMAAN</td>
<td>PROF. GRUEV</td>
<td>REWA</td>
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<td>PROF. CHOI (2050 ECEB)</td>
<td>NOMAAN</td>
<td>PROF. CHEN</td>
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<td>PROF. SCHMITZ</td>
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* 10/5: Room 2050
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

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<tr>
<th>Conditions</th>
<th>Mode</th>
<th>Behavior under Linear Model</th>
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<tr>
<td>$V_{GS} &lt; V_{TH}$</td>
<td>OFF</td>
<td>$I_D = 0$</td>
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</table>
| $V_{GS} > V_{TH}$  
$V_{DS} > V_{GS} - V_{TH}$ | 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 $V_{DD}$
Oh yeah and...

\[ P = n a f C V_{DD}^2 \]

- \( n \) = number of capacitors
- \( a \) = activity factor
- \( f \) = frequency
- \( C \) = capacitance
- \( V_{DD} \) = applied voltage
Wise Words to Make your Score Soar

• Use your note sheet more like a study tool
• Spend your time showing what you know
• Make sure to get through the whole exam
• Look at past exams
• Take the time to relax before your exam