1. For the following circuit, $V_{BE,ON} = 0.4V$, $V_{CE,SAT} = 0.2V$, $R_B = 20k\Omega$, $R_C = 2k\Omega$ and $\beta = 100$. Find $V_{CE}$ for the following input voltages.

a. $V_{in} = 0.3V$
b. $V_{in} = 1.0V$
c. $V_{in} = 1.4V$
d. Repeat a-c if there is now a diode with $V_{on} = 0.7V$ placed between $R_B$ and the BJT

2. For the following circuit: $V_{CC} = 8V$, $R_C = 2k\Omega$, and $V_{CE,SAT} = 0.2V$

a. Label the three regions of the $i_c$ vs. $V_{CE}$ curves. Hint: what are the regions of operation for a BJT?
b. What is $\beta$ of the transistor?
c. Which of the values of $i_B$ (20, 40, 60, 80\(\mu A\)) force the transistor into saturation?

3. For the following circuit, $V_{CC} = 5.2V$, $V_{BE,ON} = 0.7V$, $V_{CE,SAT} = 0.2V$ $R_B = 20k\Omega$, $R_C = 1k\Omega$ and $\beta = 100$.

a. Determine the values of $V_{o1}$, $V_{o2}$, $V_{i1}$, and $V_{i2}$.
b. What is the maximum value of $A$ that keeps the BJT in the active region when:
   i. $V_i = 1.2 + Asin(\omega t)$
   ii. $V_i = 0.9 + Asin(\omega t)$
   iii. $V_i = 1.4 + Asin(\omega t)$
c. What is the voltage gain in the active region?
4. For the following circuit, \( V_{DD} = 6V \), \( R_D = 100\Omega \) and \( I_1 = 5mA \).
   a. List the equations for \( I_D \) in the Ohmic and Active regions.
   b. Using the equations from part (a), determine the value of \( k \).
   c. Find the values of \( I_D \) and \( V_{DS} \) when:
      i. \( V_{GS} = 4V \) and \( V_{TH} = 2V \)
      ii. \( V_{GS} = 5V \) and \( V_{TH} = 1V \)

5. Fill in the truth table for the following cMOS circuit where A, B and C are inputs and Z is the output.