

ECE 320 - Quiz #5 - Name _____

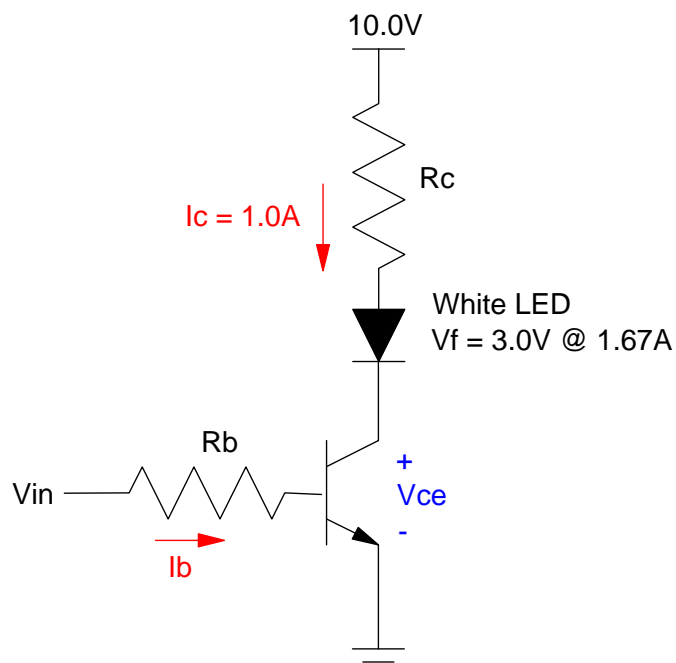
Transistors, H-Bridges, Schmitt Triggers, Buck Converters. February 27, 2020

Transistor Switch

Determine R_b and R_c so that a function generator can turn on and off a 5W LED at 1.00A. Assume

- LED: $V_f = 3.0V$ @ 1.67A
- Transistor: $V_{be} = 1.4V$, $V_{ce} = 0.9V$, $\beta = 1000$ (TIP112)
- Input: 0V / 5V binary, capable of up to 20mA

| Min value for R_b | Max value of R_b | R_c |
|---------------------|--------------------|-------|
| | | |

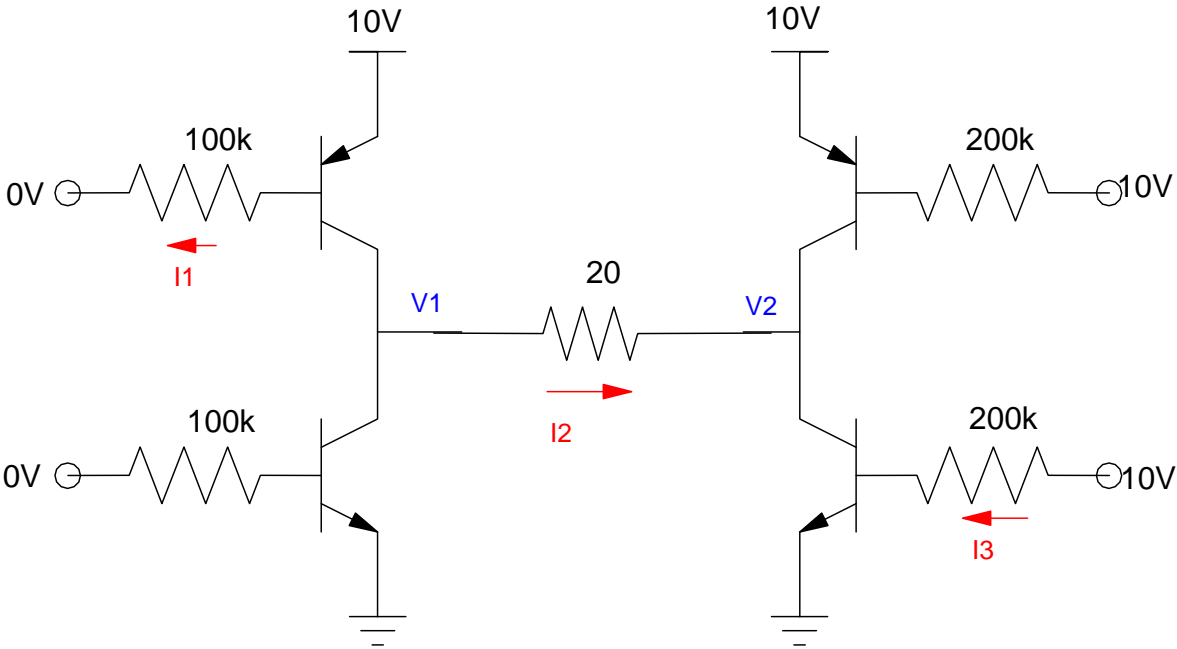


H-Bridge (analysis)

2) Determine the voltags and currents for the following H-bridge. Assume TIP transistors:

- $|V_{be}| = 1.4V$
- $|V_{ce}| = 0.9V$ when saturated
- $\beta = 1000$

| I1 | I2 | I3 | V1 | V2 |
|----|----|----|----|----|
| | | | | |

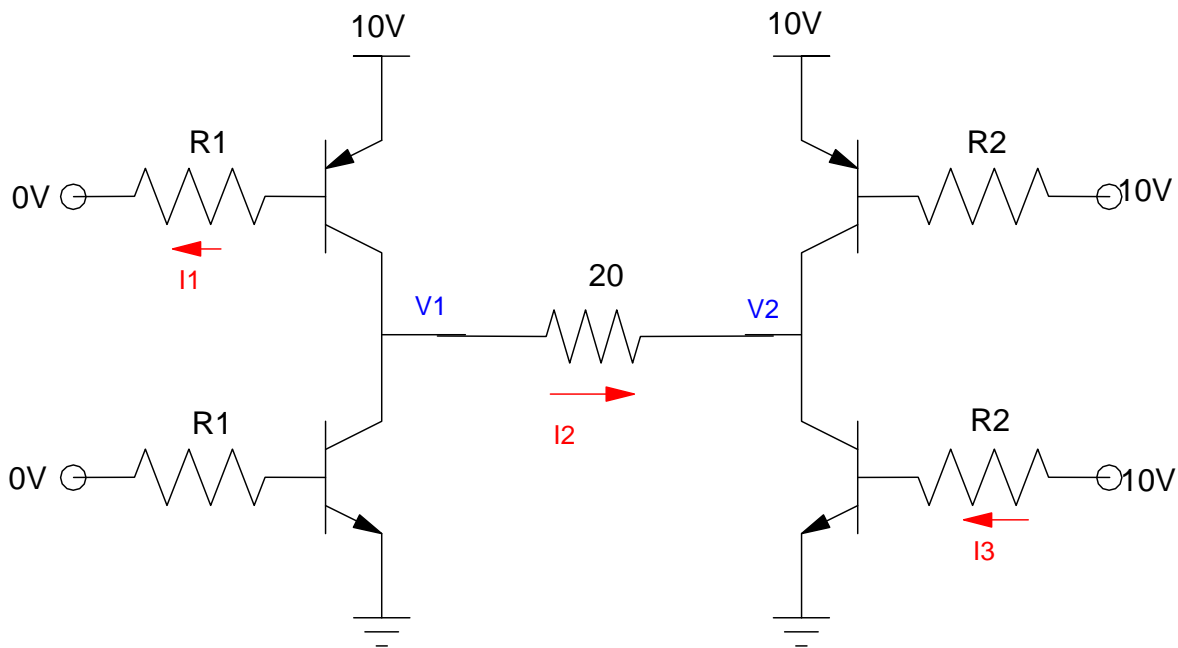


H-Bridge (design)

3) Specify R1 and R2 so that the following H-bridge has transistors which are either off or saturated. For these values of R1 and R2, determine the currents. Assume

- $|V_{be}| = 1.4V$
- $|V_{ce}| = 0.9V$ when saturated
- $\beta = 1000$
- I1 and I3 can be 20mA (or less)

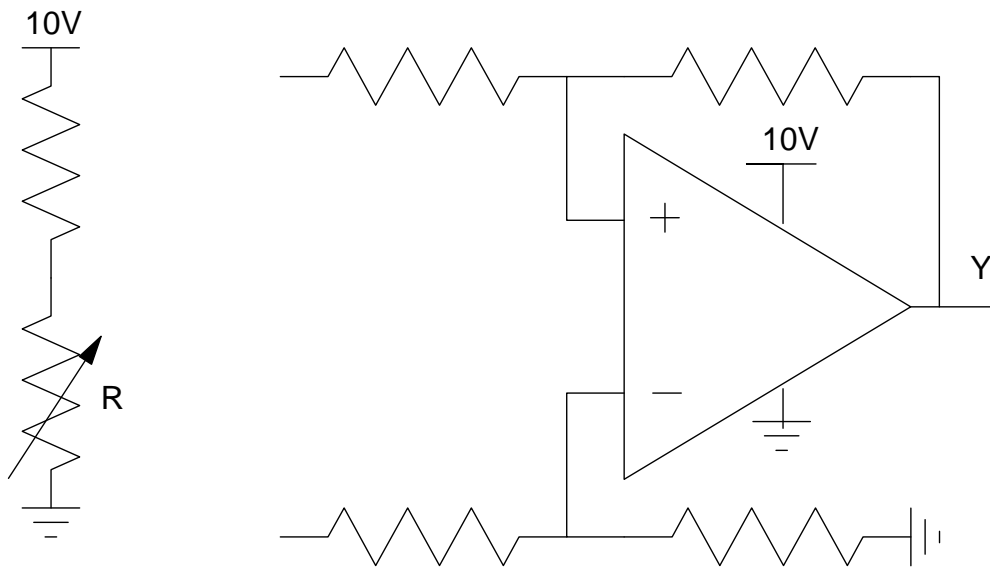
| R1 | R2 | I1 | I2 | I3 |
|----|----|----|----|----|
| | | | | |



Schmitt Trigger (design)

4) Design a Schmitt Trigger so that the output (Y) is

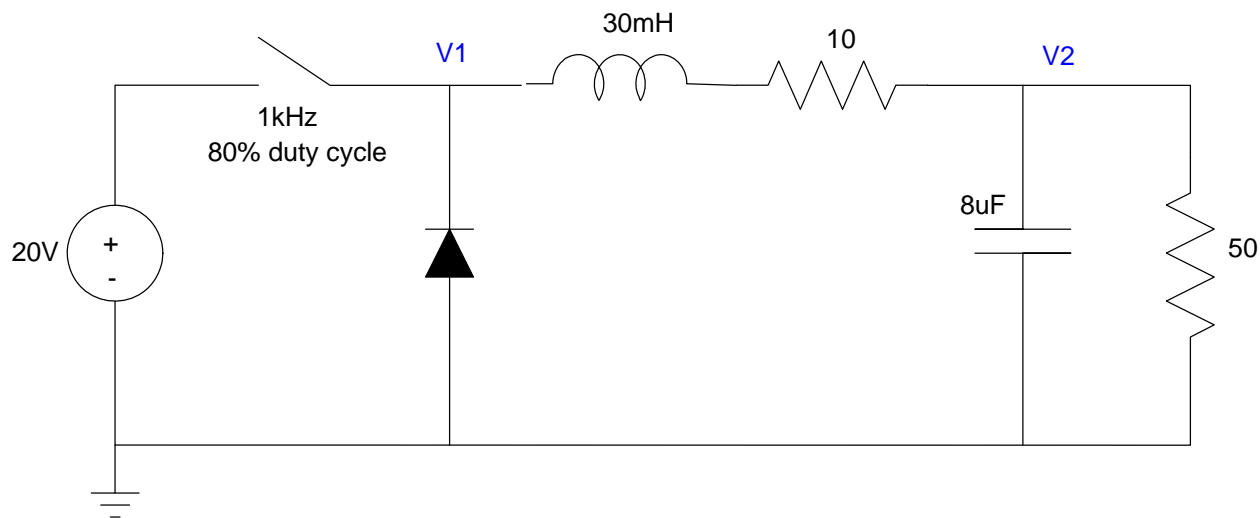
- $Y = 0V$ when $R < 4000\ \Omega$
- $Y = 10V$ when $R > 4500\ \Omega$
- No change ($0V$ or $10V$) when $4000 < R < 4500\ \Omega$



Buck Converter (analysis)

5) Determine the voltages (V1 and V2, both DC and AC) for the following Buck converter (DC to DC)

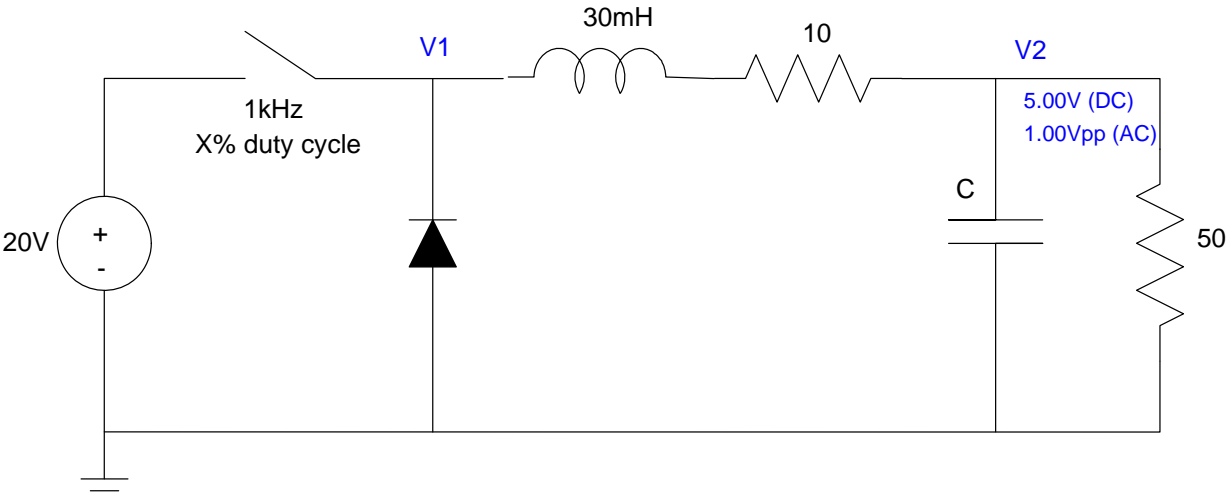
| V1 | | V2 | |
|--------|--------|--------|--------|
| V1(DC) | V1(AC) | V2(DC) | V2(AC) |
| | | | |



Buck Converter (design)

6) Design a Buck converter so that the output is 5.00V DC with a ripple of 1Vpp

| DC Voltage at V1 | Duty Cycle (% on) | C |
|------------------|-------------------|---|
| | | |



Bernie Sanders Bonus! Suppose Bernie Sanders had two voles in his yard (one male, one female) but no cat. How many voles would he have after 12 months? (i.e. how fast do voles multiply?) (assume 6 pups per litter, one litter every 30 days, 60 days to reach maturity)