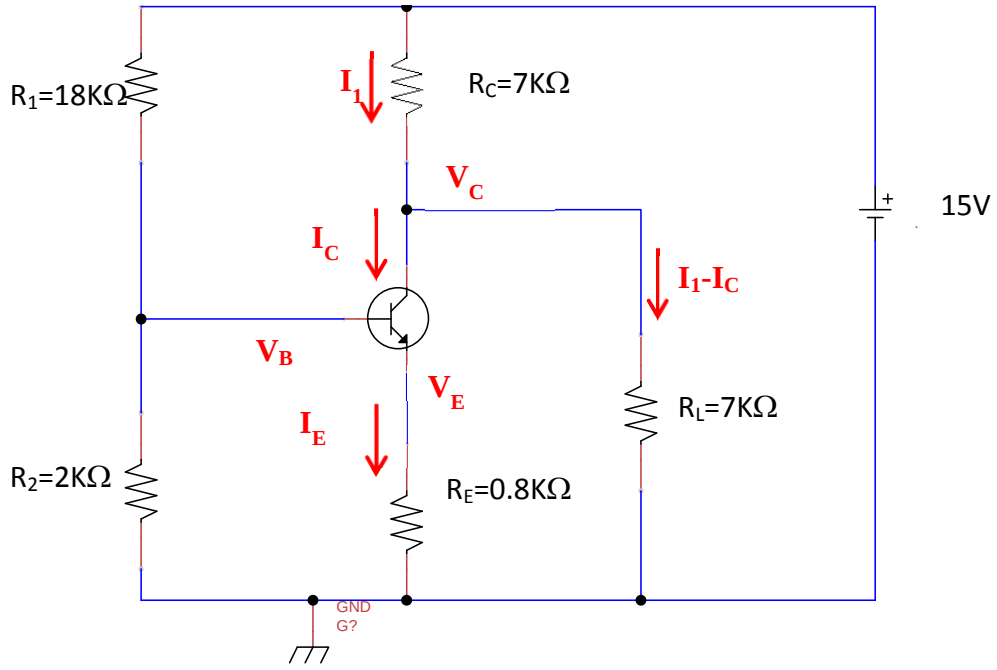
Time = 25 minutes

Name _____ Student ID_____

Question 1 – 7 points

Consider the following circuit. If β=200. Find the voltages at the three transistor terminals and the current in the terminals. As a first approximation, you can neglect the base current compared to the current in the biasing resistors (R_1 and R_2).



Since I_B is very small compared to the current in R_1 and R_2, I will assume that $I(R_1)=I(R_2)$, so R_1 and R_2 act as a potential divider

$V_B=15*2/(2+18)=1.5V$

Assuming the transistor is ON, V_{BE} = 0.7, so $V_E = V_B-V_{BE}$

$V_E=1.5-0.7=0.8V$

Since V_E=0.8V, There is a voltage drop of 0.8 across R_E

I_E=0.8/0.8 = 1mA

Since β is very high (200), α is close to 1 (0.995) and $I_C \approx I_E$ = 1 mA (0.995 to be exact)

IB=IC/β

I_B=0.005mA

By applying KVL on the rightmost loop

$15=7I_1 + 7(I_1-I_C)$

I_1=22/14=1.5714 mA

V_C= 15-1.5714*7 or (1.5714-1)*7 = 4V

Question 2 – 3 points

In a BJT biased in the active-forward region, the base current i_B=2.8 μA and the emitter current is i_E=325μA.

Find β, α, i_C.

$I_C=I_E-I_B$ = 325-2.8 = 322.2 μA

$\beta=I_C/I_B$ = 322.2/2.8 = 115.0714

$\alpha=\beta/(\beta+1)$=0.991385