E E 311

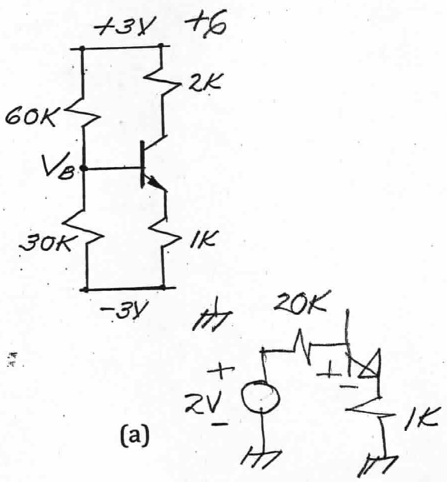
EXAM 3 (100pts)

November 8, 2013

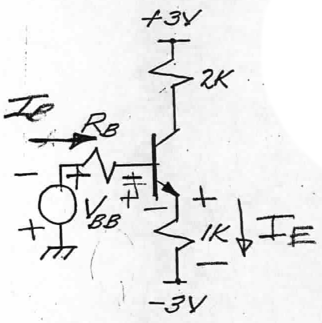
Name _____

ID _____

(25pts) 1.



(a)



(b)

a) Determine the values of R_B and the dc voltage source V_{BB} for the circuit "b" to be equivalent to circuit "a". *(Pay attention to signs)*

R_B = 20K (4pts)

V_{BB} = −1V (5pts)

b) Determine I_E, I_B, I_C and V_B if $\beta = 49$ and $|V_{BE}| = 0.6V$.

I_E = 1mA
I_B = 0.02mA } (8pts)

I_C = 0.98mA (3pts)

V_B = −1.4V (5pts)

E E 311

EXAM 3 (100pts)

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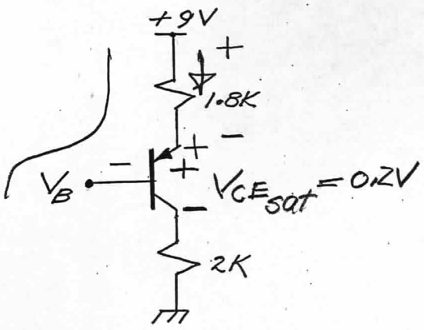
Name _____

ID _____

(26pts) 2.



For the given values of V_B below, estimate I_B , I_E , I_C and the collector voltage, V_C , assuming β very large, $|V_{BE}| = 0.6V$ and $|V_{CE(sat)}| = 0.2V$.

i) $V_B = 5.7V$

$I_B =$ 0 (3pts)

$I_E =$ 1.5mA (3pts)

$I_C =$ 1.5mA (3pts)

$V_C =$ +3V (3pts)

ii) $V_B = 3V$

$I_B =$ 1.3V (4pts)

$I_E =$ 3mA (3pts)

$I_C =$ 1.7mA (3pts)

$V_C =$ 3.4V (4pts)

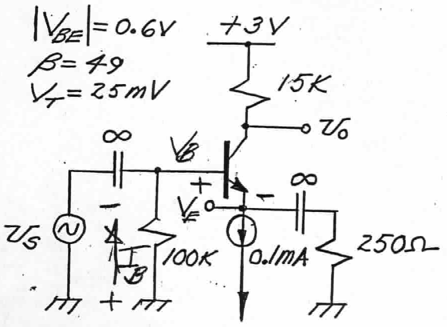
7pts

E E 311

EXAM 3 (100pts) Name _____

November 8, 2013 ID _____

(25pts) 3.



a) For the circuit shown, determine the dc voltage at the emitter, V_E.

-1 if -0.4
-2 if -0.6

$V_E =$ -0.8V (4pts)

b) Determine values for the small-signal parameters g_m, r_π and r_e. *(Make simplifying assumptions)*

4mS, 0.004

$g_m =$ 3.92mS (3pts)

$r_\pi =$ 12.5K (3pts)

$r_e =$ 250Ω (3pts)

= 12.5KΩ

c) Draw the small-signal circuit using the "T" model for the transistors. *(Label all circuit elements).* (6pts)

d) Derive and calculate the voltage gain v_o/v_s.

-29.4

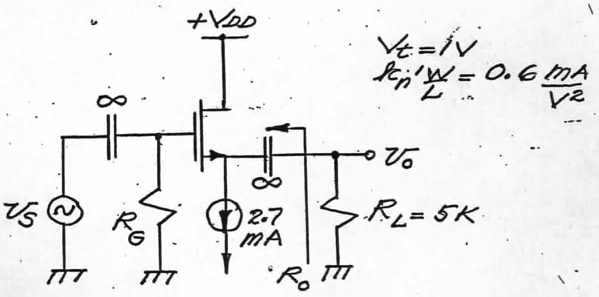
$v_o/v_s =$ -30 (6pts)

EE 311

EXAM 3 (100pts) Name _____

November 8, 2013 ID _____

(24pts) 4.



a) For the circuit shown, determine the value of g_m and draw the small-signal equivalent circuit using the "T" model for the MOSFET. *(Label all model and circuit elements)* (6pts)

$1.8X10^{-3}S$; $1.8\frac{mA}{V}$

g_m= 1.8mS (6pts)

b) Using the circuit in "a)" above, derive and calculate the voltage gain $A_V = \frac{VO}{VS}$.

A_V = 0.9 (6pts)

c) Using the circuit in a) above, derive and calculate the output resistance, R_O, seen by the load R_L.

555Ω

R_O= 0.55K (6pts)