ENEL434 Pop quiz

1) For the CE amplifier shown in Fig.1 find:
   a. The base current I_B
   b. The collector current I_C
   c. The voltage V_{CE}
   d. The emitter resistor re
   e. The small signal mid band gain $|v_{out}/v_{in}|$
   f. The input impedance at midband
   g. The low frequency limit in Hz

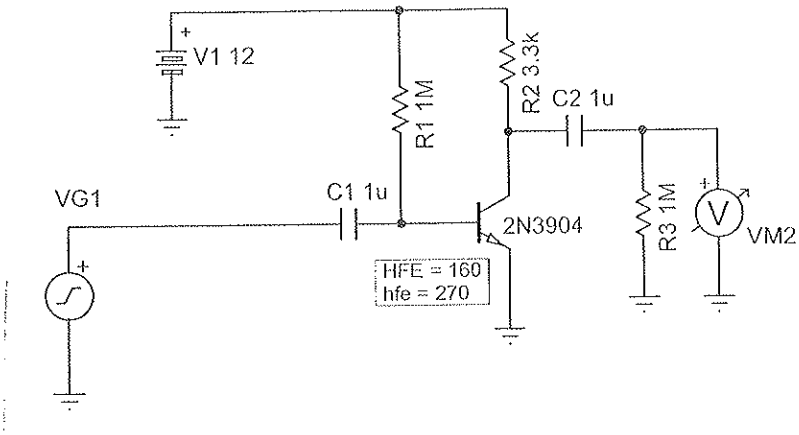

Figure 1. A truly dreadful CE amplifier

2) For the circuit shown in Fig.2 and using the Thevenin equivalent network for the base bias circuit, find

a) I_B,
b) I_C and
c) V_{CE}
d) the small signal gain $|v_{out}/v_{in}|$

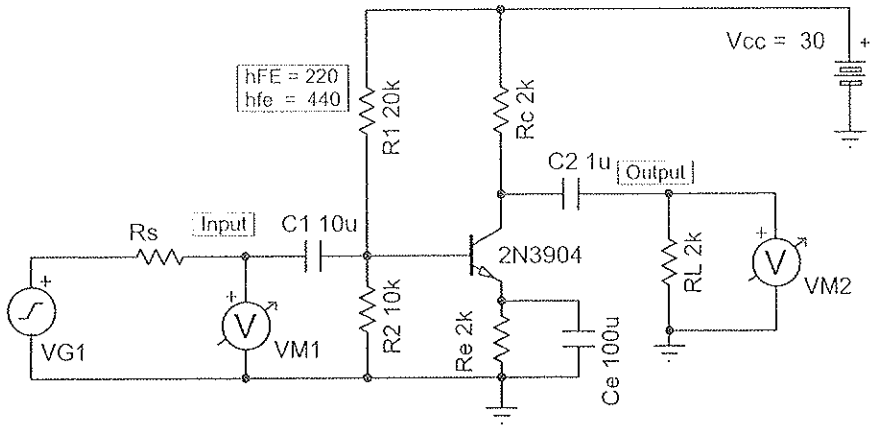

Figure 2. A well-biased CE amplifier

Answers to Pop Quiz ENEL434
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(1) (a) $I_B = (12 - 0.7)/10^6 = 11.3\mu A$

(b) $I_c = h_{FE} I_B = 160 \times 11.3 \times 10^{-6}$
$= 1.8 mA.$

(c) $V_{CE} = 12 - 1.8 \times 10^{-3} \times 3.3 \times 10^3$
$= 6.06 V$

(d) $r_e = 0.026 / 1.8 \times 10^{-3} = 14.4 \Omega.$

(e) $A_{v(ss)} = -\dfrac{3.3k // 1M}{14.4} = -229$

(f) $R_{in} (f > f_L) = 1M // h_{fe} \cdot r_e$
$= 1 \times 10^6 // 270 \times 14.4 \approx 3.9 k\Omega$

(g) $f_L = 1/2\pi\, 3.9 \times 10^3 \times 1 \times 10^{-6}$
$= 41 Hz.$

Probably none of these answers will be that precise since h_{FE} ($\alpha\beta$) and h_{fe} vary over large spans.

More realistic answers

(a) $I_B = 10\mu A \pm 2\mu A.$

(b) $I_c = 1.8mA \pm 2mA.$

(c) $V_{CE} = 6 \pm 1 V$

(d) $r_e = 14 \pm 2 \Omega$

(e) $A_v = -225 \pm 25$

(f) $R_{in} = 4 k\Omega \pm 1 k\Omega$

(g) $f_L = 40 \pm 10 Hz$

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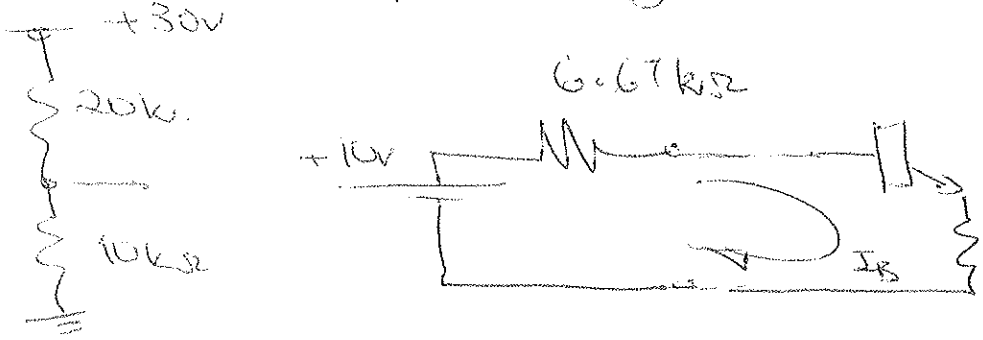
(2) Answer to Pop Quiz



(a) $V_{TH} = 10V$, $R_{TH} = 6.67\,k\Omega$

$$10 - I_B \times 6.67 \times 10^3 - 0.7 - I_B \times 220 \times 2 \times 10^3 = 0$$

$$I_B = 9.3 \,/\, (6.67 + 440) \times 10^3$$

$$= 21\,\mu A.$$

(b) $I_C = 4.6\,mA$.

(c) $$V_{CE} = 30 - 4.6 \times 10^{-3} \times 2 \times 10^3 - 4.6 \times 10^{-3} \times 2 \times 10^3$$
$$= 11.6\,V$$

(d) $$A_{VSS} = -\underbrace{2k \,//\, 2k}_{R_C \,//\, R_L} \Big/ \underbrace{5.7}_{r_e} = -175$$