

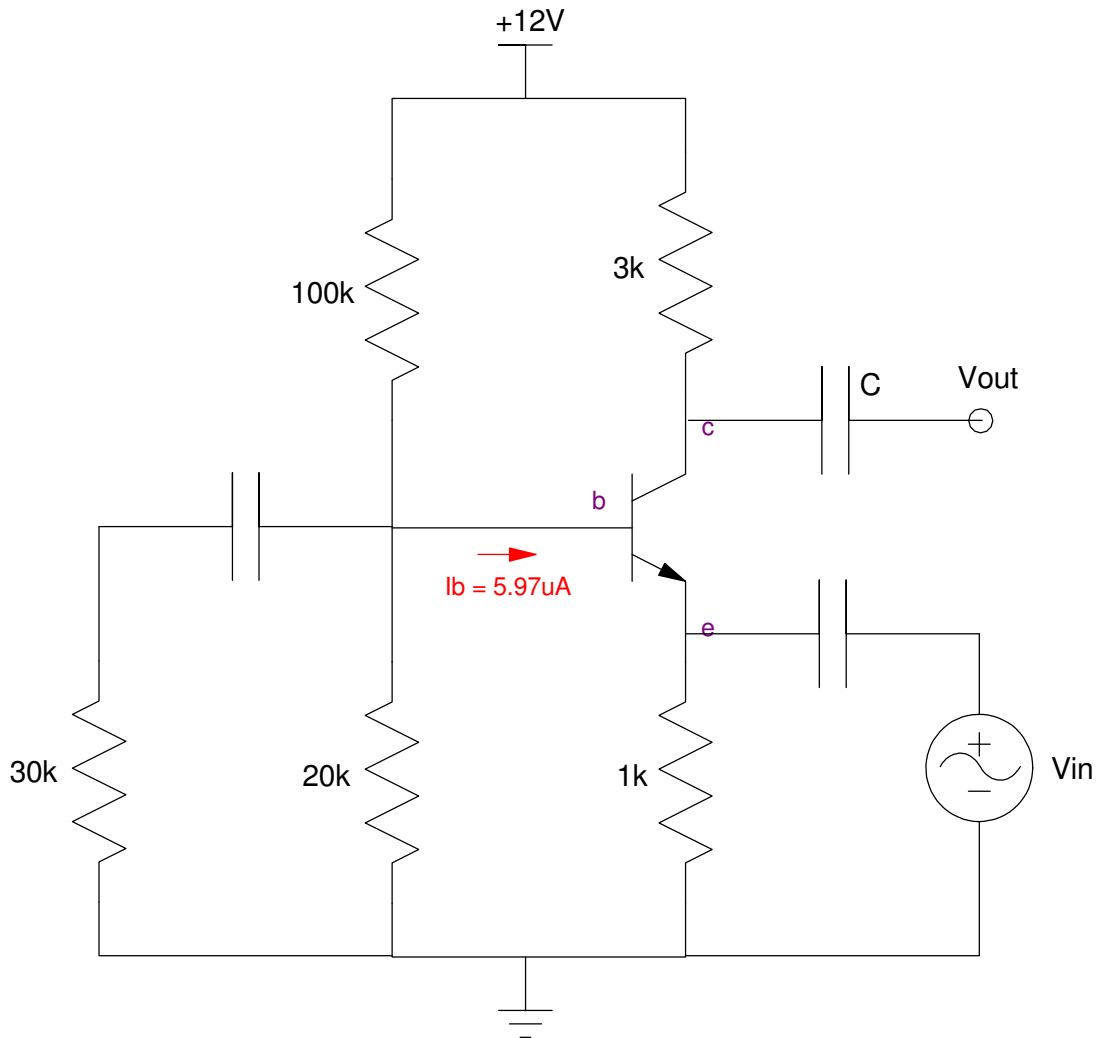
# ECE 321: Handout #15

Common Base / Common Collector

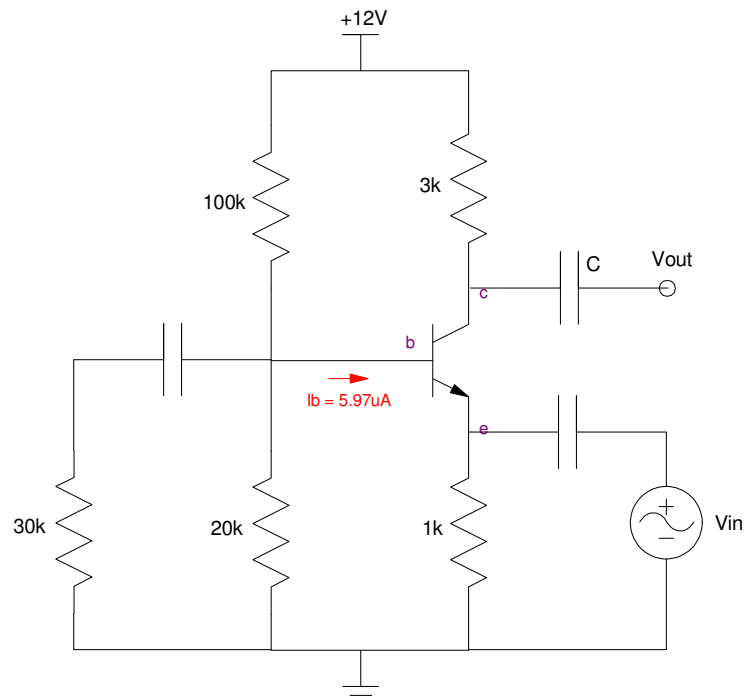
1) Draw the small signal model for the following CB amplifier. Assume

$$r_f = \frac{0.026}{I_b} = 4355\Omega$$

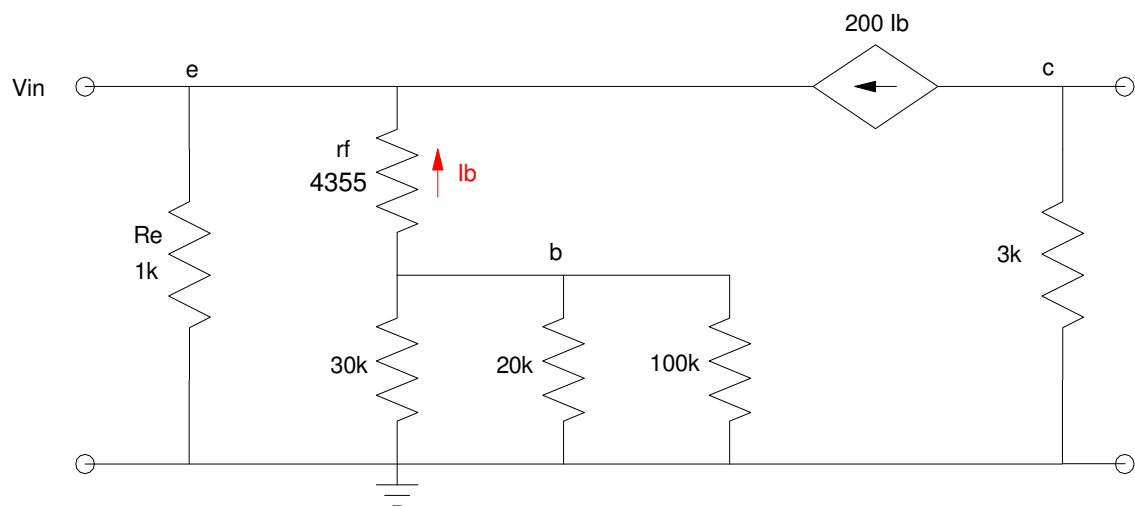
2) Determine the 2-port model for this amplifier



## Solution



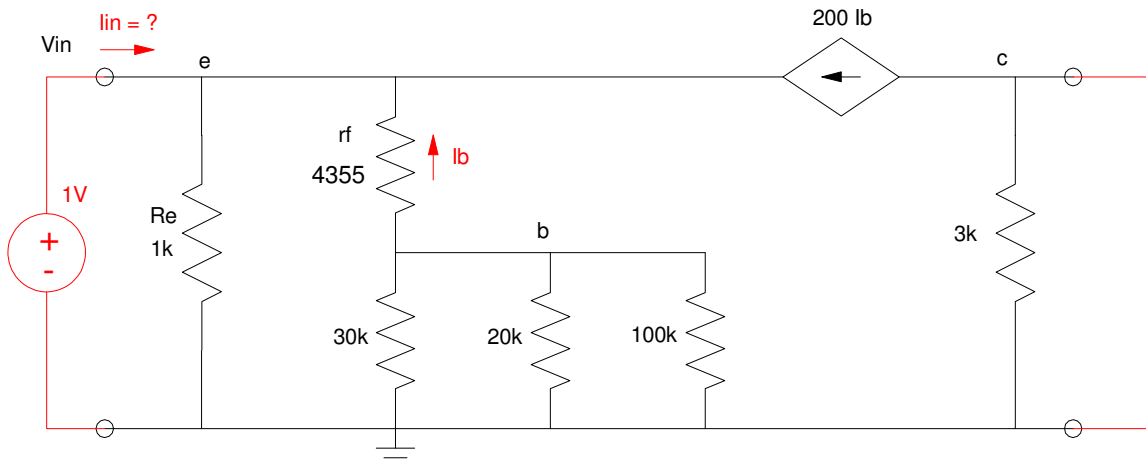
First, redraw the circuit



Now find the two-port parameters

Rin:

- Sort Vout
- Apply 1V at Vin and compute Iin



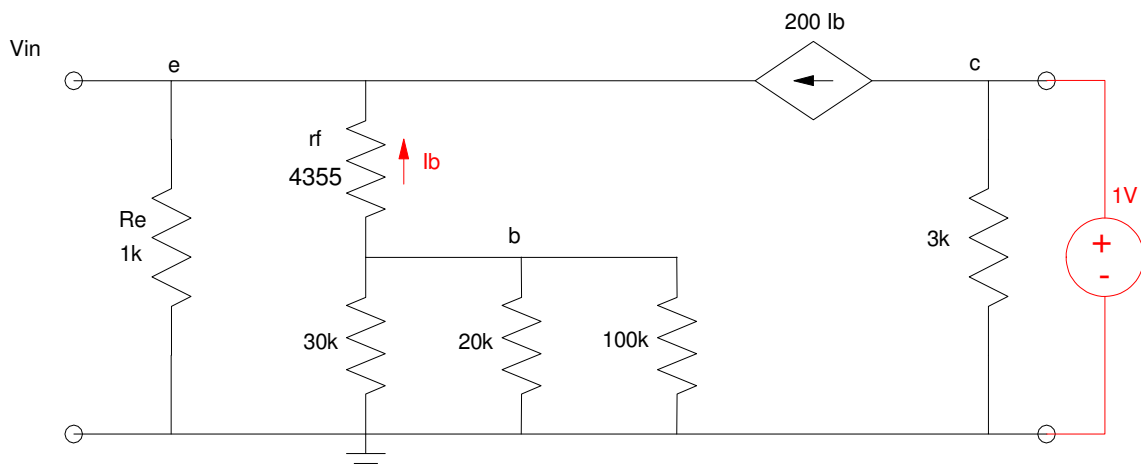
$$I_{in} = \frac{1V}{1k} + \frac{1V}{4355 + 30k \parallel 20k \parallel 100k} + 200 \left( \frac{1V}{4355 + 30k \parallel 20k \parallel 100k} \right)$$

$$I_{in} = 14.34mA$$

$$R_{in} = \frac{1V}{14.34mA} = 69.74\Omega$$

Ai: Set Vo = 1V, compute Vin

- Vin = 0
- Ai = 0



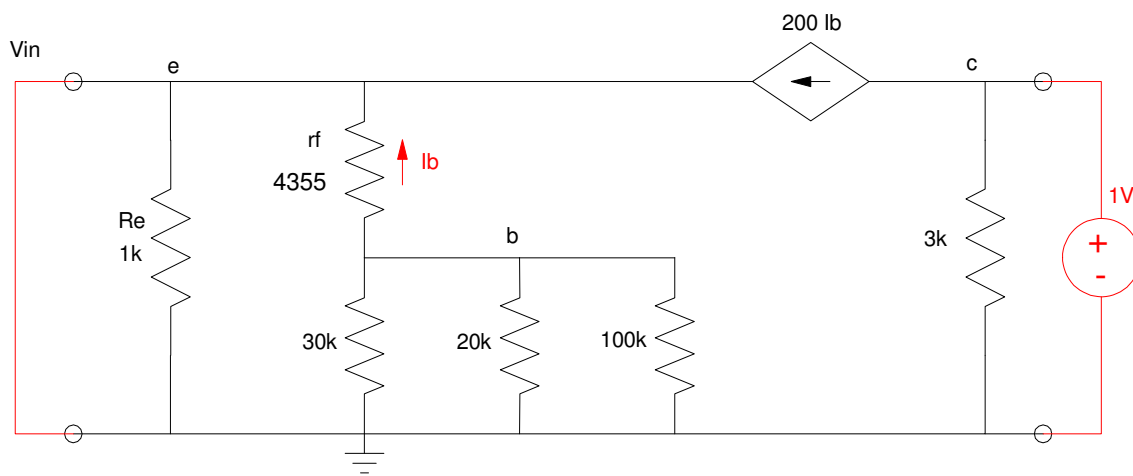
Rout:

- Short  $V_{in}$ .
- Apply 1V at  $V_{out}$  and
- Computer  $I_{in}$

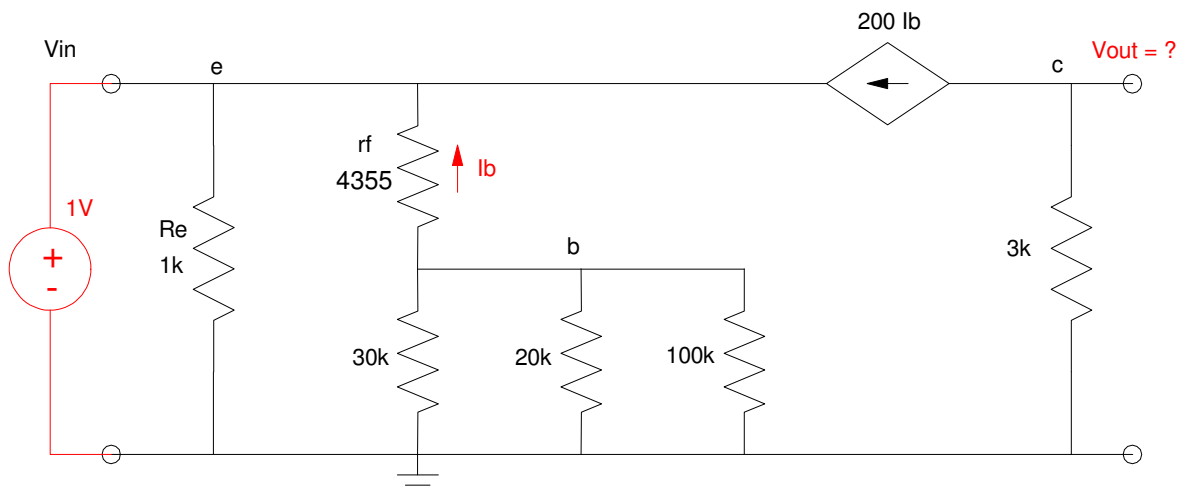
$$I_b = 0$$

$$I = \frac{1V}{3k} = 333\mu A$$

$$R_{out} = \frac{1V}{333\mu A} = 3k$$



Ao: Apply 1V at Vin, compute Vout



$$I_b = \frac{-1V}{4355 + 30k \parallel 20k \parallel 100k} = -66.36 \mu A$$

$$200I_b = -13.27 mA$$

$$V_{out} = -3000 \cdot 200I_b = 39.82 V$$

$$A_o = +39.82$$

The 2-port model is thus

