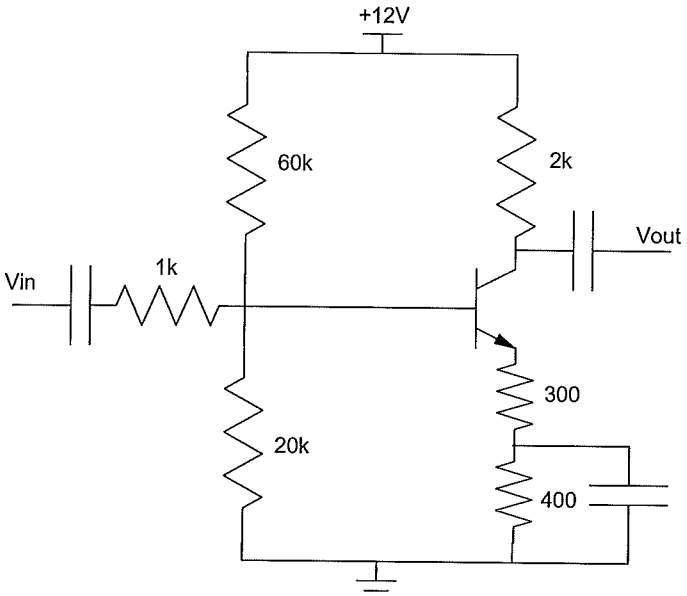
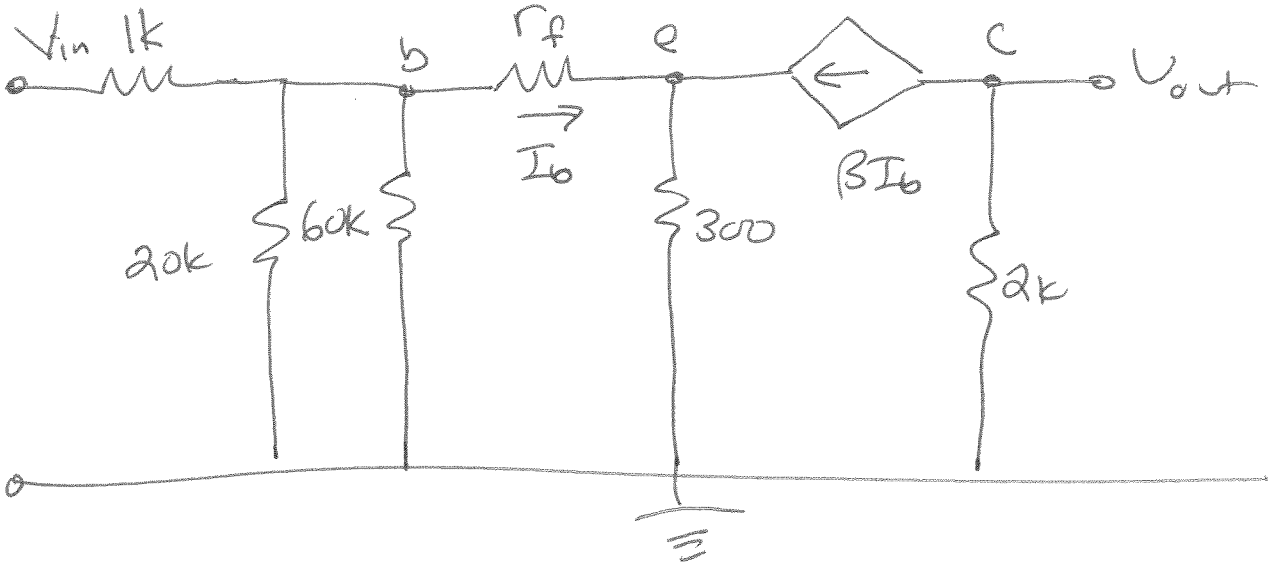
ECE 321: Quiz #5 Name _____

AC analysis of BJT amplifiers - December 8, 2016

1) Draw the small-signal model (AC circuit) for the following common-emitter amplifier. Assume

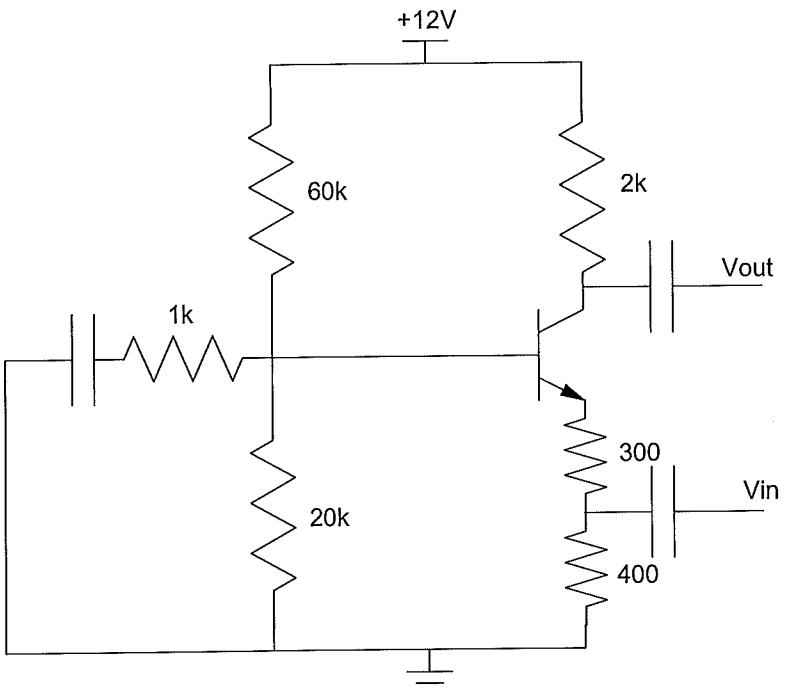
- $I_b = 26.8\mu A$
- $r_f = 1937\Omega$
- $\beta = 100$

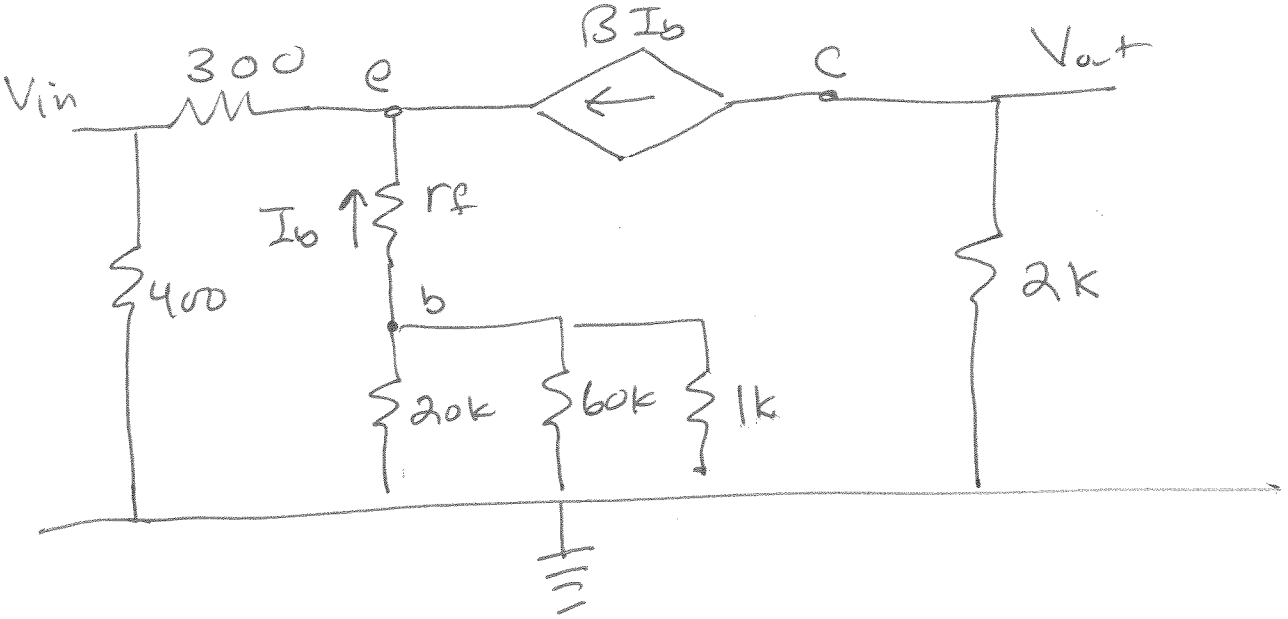




2) Draw the small-signal model (AC circuit) for the following common-base amplifier. Assume

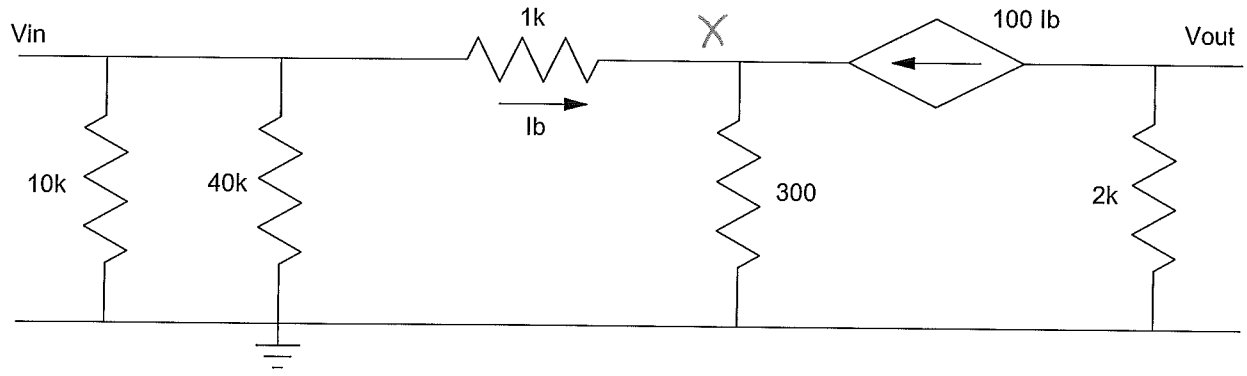
- $I_b = 26.8\mu A$
- $r_f = 1937\Omega$
- $\beta = 100$





3) Determine the 2-port parameters for the following common-emitter amplifier:

Rin	Ai	Rout	Ao
6372	0	2k	-6.38



Rin

Short V_o

Apply 1V@V_{in}

$$I = \frac{1}{10k} + \frac{1}{40k} + \frac{1-.9681}{1k} = 156\mu A$$

$$\frac{X-1}{1k} + \frac{X}{300} + 100\left(\frac{X-1}{1k}\right) = 0$$

$$X = .9681V$$

$$R_{in} = \frac{1}{I} = 6372\Omega$$

Ai

apply 1V@ V_o

$X = 0$

Rout

Short V_{in}

Apply 1V@V_{out}

$X = 0$

Ao

apply 1V @ V_{in}

$X = .9681$

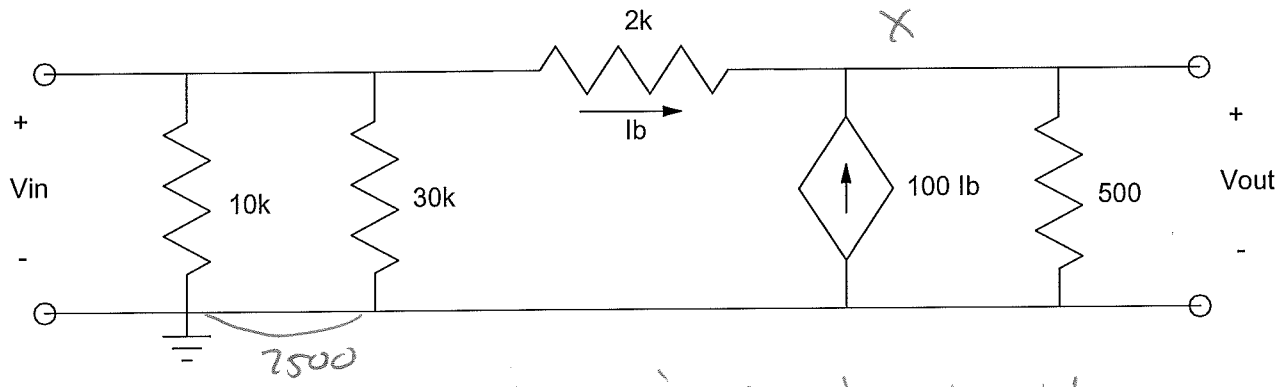
$I_b = 31.9\mu A$

$100 I_b = 3.19mA$

$2k \cdot 1\Omega \cdot I_b = 6.38V$

4) Determine the 2-port model for the following amplifier:

Rin	Ai	Rout	Ao
1579	.7895	19.05	.9619



Rin Short Vo

$R_{in} = 10k \| 30k \| 2k = 1579$

Ai $\left(\frac{7500}{2k+7500}\right) = .7895$

Rout Short Vin, apply 1V

$I = \frac{1}{500} + \frac{1}{2k} + \frac{100}{2k}$

$I = 52.5mA$

$R_o = 1/I = 19.05\,\Omega$

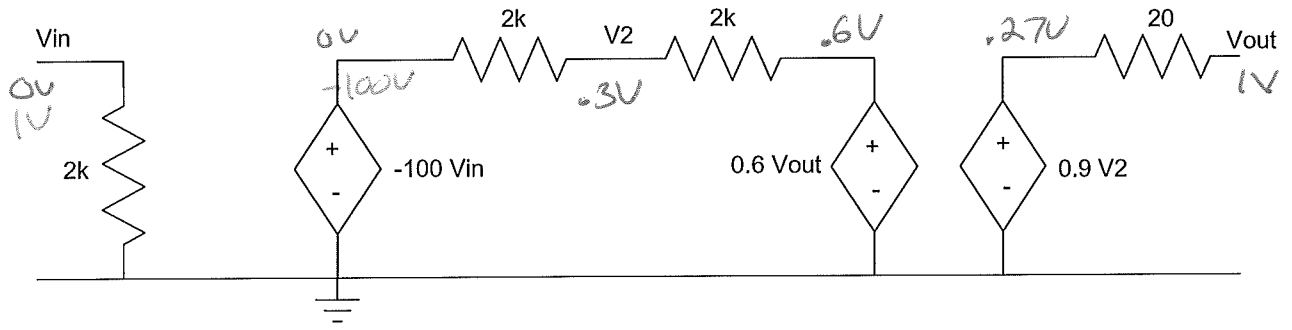
Ao apply 1V @ Vin

$\frac{X-1}{2k} + \frac{X}{500} + \frac{100(X-1)}{2k} = 0$

$X = .9619$

5) Determine the 2-port model for the following CE:CC amplifier:

Rin	Ai	Rout	Ao
2k	0	27.4Ω	-61.64



Rout short Vin
apply 1V@Vo

$I = \frac{1-.27}{20} = 36.5mA$

$R = \frac{1}{I} = 27.4\Omega$

Av apply 1V@ V_{in}

$V_2 = -50 + (\frac{1}{2})(.6)(.9V_2)$

$V_2 = \frac{-50}{1-.27} = -68.49$

$V_o = .9V_2 = -61.64$

Bonus! Electorial College Trivia! Suppose you eliminate the electorial college and elected Presidents by the popular vote. How many western states would it take to equal the number of people in New York City (population 8,550,405)? (8)

ND 723k
SD 844k
MT 1015k
AK 735k
WY 582k
KS
NB
OK
Id 1612
NM 2085
Hawaii 1404
6.924m