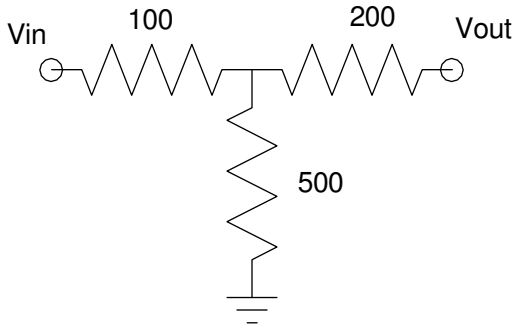
ECE 321 - Homework #4

2-Port Models, DC Bias for Transistors, Common Emitter Amplifier. Due Monday, April 23rd, 2018

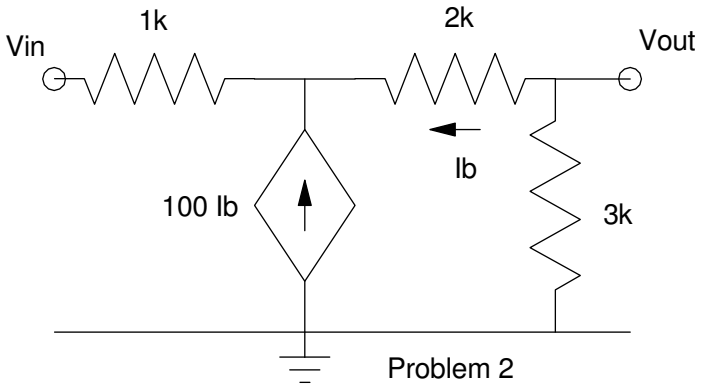
2-Port Model

1) Find the 2-port model for the following circuit

2) Find the 2-port model for the following circuit



Problem 1



Problem 2

Q-Point Design

3) Determine the Q-point for the following circuit. Assume ideal silicon transistor with

- $\beta = 100$
- $|V_{be}| = 0.7V$
- $\min(|V_{ce}|) = 0.2V$

4) Change this circuit so that the Q-point is

- Vce = 6V, and
- Stabilized for variations in β

Common Emitter

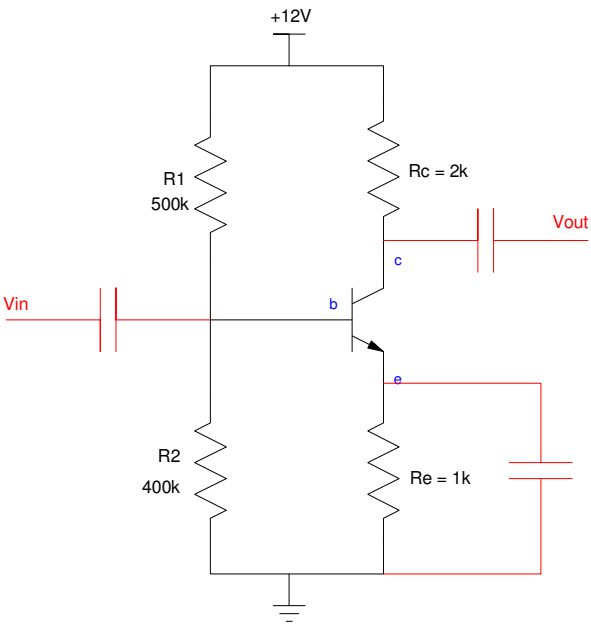
5) Determine the 2-port model for the following common emitter amplifier

6) Check your analysis in PartSim with

- A load at Vout of 1M Ohm
- A load at Vout of 2k Ohms

Is the gain you computed correct?

Is the output impedance you computed correct?



Problem 3

Problem 5)

Lab (over)

Lab

7a) Specify the overall requirements for a circuit which incorporates the hardware built in previous homework assignments. For example:

- Input: +/- 1V AC signal capable of driving 1mA (i.e. a cell phone)
- Output: 8 Ohm Speaker
- Relationship:
  - 9 < gain < 11 for frequencies less than 200Hz
  - gain < 1 for frequencies above 600Hz

7b) Specify how this design is split into three secions and the requirements for each section. For example:

Secion 1: Amplfier

- Input: +/- 1V AC signal capable of driving 1mA (i.e. a cell phone)
- Output: +/- 10V AC signal capable of driving 1kOhm
- Relationship: y = 10x (+/- 10%)

Section 2: Filter

- Input: +/- 10V AC signal capable of driving 1kOhm
- Output: +/- 10V AC signal capable of driving 1kOhm
- Relationship:
  - 9 < gain < 11 for frequencies less than 200Hz
  - gain < 1 for frequencies above 600Hz

Section 3: Push-Pull Amplifier

- Input: +/- 10V AC signal capable of driving 1kOhm
- Output: 8 Ohm speaker
- Relationship: y = x (+/- 10%)

(next week - homework #5): Assembler your three circuits together and collect data to validate

- Each section works separately
- The entire circuit works together