In this lab you will design a common emitter amplifier to meet a set of given specifications. You may do so by selecting component values for the common emitter amplifier pictured in Figure 1. You may, if you prefer, select a different biasing scheme, make small modifications to this design or select another amplifier, but the schematic in Figure 1 is sufficient to meet the specifications of this lab.

You must begin your design by making hand calculations which help you pick your component values. After that you should simulate your design to make sure those component values work in simulation. Finally, you must build your design and experimentally show that it meets the design specifications. Be sure to calculate, simulate and measure the power consumption of your design.

The design specifications are as follows:

- $R_{in} > 1\text{k}\Omega$
- $R_{out} < 5\text{k}\Omega$
- $A_v = 200 \pm 10\%$
- $V_{sw} > 2\text{V}$ as measured by absence of visible clipping, not by harmonic content.
- $f_{low} < 2\text{kHz}$
- Use only one 12 V power supply.
- Your signal source has a source impedance > 8 Ω and may not have any DC offset
- Use one transistor: a 2N3904
2 Design Project 1

Design an amplifier which meets the following specifications

- $R_{in} > 20\,\text{k\Omega}$
- $R_{out} < 50\,\Omega$
- $A_v = 1000 \pm 5\%$
- $V_{sw} > 5\,\text{V}$ as measured by harmonic content which is at least 10dB below the fundamental.
- $f_{low} < 2\,\text{kHz}$
- Use only one 10 V power supply. (This constraint does not apply to your attenuator.)
- Input signal source has a source impedance of 50 Ω and may not have any DC offset.
- Use four or fewer transistors, up to two 2N3906s and up to two 2N3904s.
- Optimize for minimum power consumption and minimum component count.

As above, design the amplifier on paper, simulate it, build it, and experimentally verify its performance. You may need to build an attenuator to make your input signal small enough that your output does not exceed your output swing because of the high gain of the amplifier. Figure 2 depicts an attenuator design that can easily achieve 60dB or more of attenuation. Applying Thevenin analysis makes it much easier to design your attenuator.