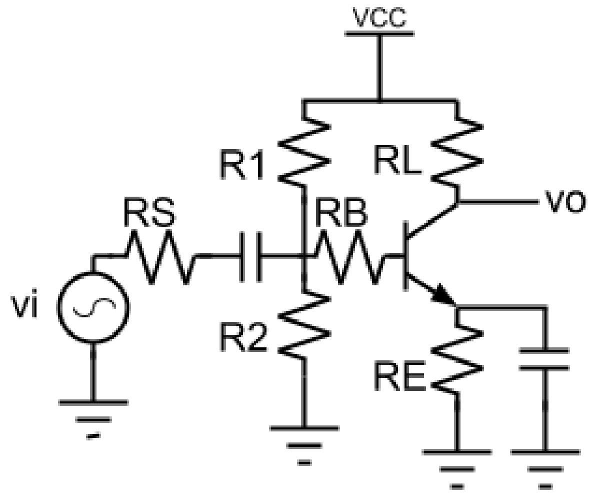

Figure 1: An example design for a common emitter amplifier.

1 Warm-Up Problems

1. The above circuit is a common emitter amplifier with a practical biasing scheme. Assume it operates in the mid-band and that R_s is part of the source rather than the amplifier. Find r_{in}, r_{out}, a_v and V_{SW} for this amplifier.

2. What is the current gain, a_i, for a common emitter amplifier? Current gain is measured by applying a test current source at the amplifier input and measuring the current through a small signal short at the amplifier output.

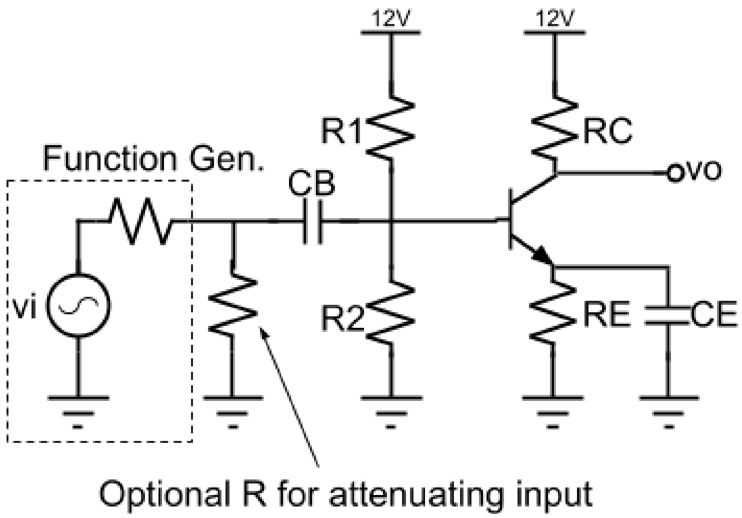

Figure 2: A sample design for a common emitter amplifier.

2 Lab Introduction

In this lab you will build and characterize a common emitter amplifier. This is practice for the design project, where you will use a small number of transistors to design a (possibly multistage) amplifier to a specification. The learning goals are listed below:

- Understand the design process for amplifiers, a process which applies to most analog circuits
- Practice reconciling analysis, simulation and measurement.

3 Lab 4 – Design a Common Emitter Amplifier

In this lab you will design a common emitter amplifier to meet the set of design specifications below. You may do so by selecting component values for the common emitter amplifier pictured in Figure 2. 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 2 is sufficient to meet the specifications.

You must begin your design by making hand calculations which help you pick your compnent 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.

- $r_{in} > 1\text{k}\Omega$
- $r_{out} < 5\text{k}\Omega$
- $a_v = 200 \pm 10\%$. Note that in order to measure your a_v you need to separate out your voltage gain from loading from your input source; i.e.: $a_v \neq v_o/v_i$.
- $V_{SW} > 2$V as measured by absence of visible clipping, not by harmonic content.
- $f_{low} < 2$kHz
- Use only one 12 V power supply.
- Your signal source has a source impedance $> 8\ \Omega$ and may not have any DC offset
- Use one transistor: a 2N3904