ELEC 139/141
Analogue Electronics
Lab 4 - BJT Amplifier *

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1 Bipolar Junction Transistor (BJT) Amplifier

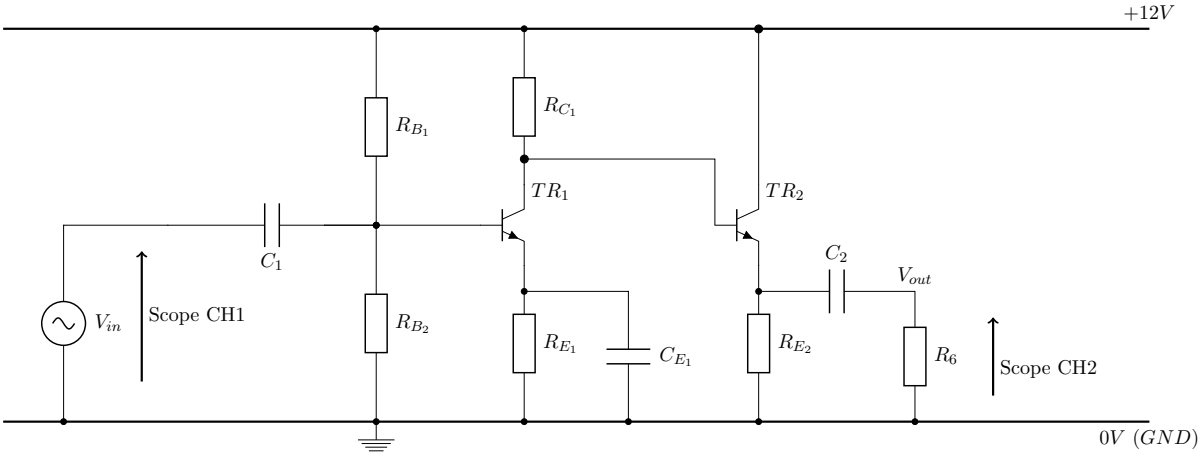
This lab investigates the design of a Common Emitter (CE) single stage amplifier with an Emitter Follower output stage based upon the BC547 series transistor. Construct the circuit shown in Fig 1a below on the breadboard.

1.1 Learning Outcomes

By the end of this lab exercise you should be able to:

- Identify types of transistor amplifier circuits
- Fully analyse a transistor amplifier circuit
- Design and build a transistor amplifier circuit to satisfy a specified frequency response

1.2 BJT Information



(a) Schematic

Circuit Ref	Value
C_1	$680nF$
R_{B_1}	$47k\Omega$
R_{B_2}	$13k\Omega$
TR_1	BC547
R_{C_1}	$5.1k\Omega$
R_{E_1}	$2k\Omega$
C_{E_1}	$680nF$
TR_2	BC547
R_{E_2}	$1.8k\Omega$
C_2	$10\mu F$
R_6	$10k\Omega$
R_4	$51R$

(b) Component Values

Figure 1: BJT Amplifier Circuit

1.3 Tasks for Common-Emitter amplifier

1. Calculate the quiescent bias voltages and currents using the approximation method, also carry out measurements to confirm the theory
2. Experimentally confirm the Common-Emitter amplifier is inverting
3. Measure and show calculations of the -3dB frequency, include derivation of the formula
4. Understand the principle of a passive High-Pass filter
5. Proteus simulation of Bode plots
6. Measure the mid-band voltage gain of TR_1 without C_{E_1} present, confirm the theory
7. Calculate the mid-band stage input and output impedance of TR_1
8. Insert the emitter bypass capacitor C_{E_1} and examine by experiment the effect on the mid band gain of the amplifier and also its effect on the stage input impedance of TR_1
9. Experimentally verify the mid-band frequency response of the circuit with C_{E_1} in place (low frequency end). The first low frequency corner is given by

$$f_{1_{LF}} = \frac{1}{2\pi C_{E_1} r_e} = \frac{1}{2\pi \times 680nF \times 25} = 9.36kHz$$

10. Build the complete circuit in Proteus and carry out the simulation to confirm your experimental results and theoretical predictions
11. Confirm the unity gain of TR_2
12. Calculate the mid-band stage output impedance of the emitter follower TR_2