Name: ____

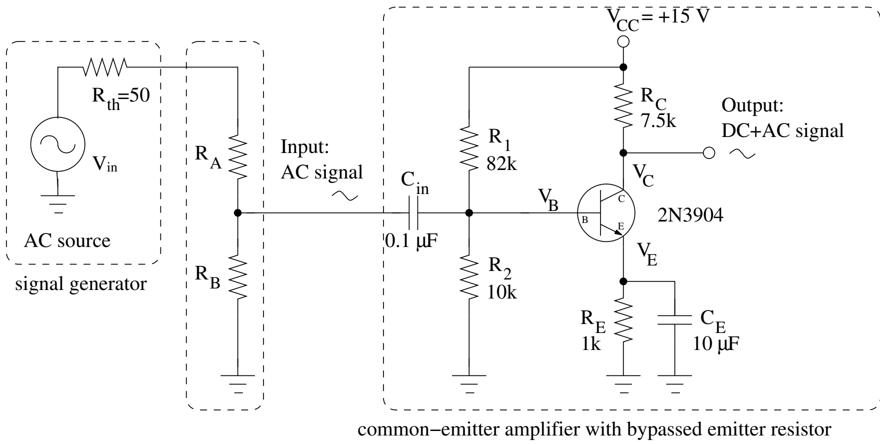

Figure 1: The common-emitter amplifier with bypassed resistor: R_C = 7.5 kΩ, R_E = 1.0 kΩ, R_1 = 82 kΩ, R_2 = 10 kΩ, V_{CC} = +15 V, 2N3904 transistor, 10 µF emitter capacitor, 0.1 µF blocking capacitor (on the input). Also shown are the 50 Ω signal generator and the voltage divider.

1. For the common-emitter amplifier circuit shown in Fig. 1 consider the DC-voltages and currents when no AC-input is present. Draw the equivalent "DC-circuit" and calculate the quiescent voltages V_B and V_C and the quiescent collector current I_C.

2. Derive the (small-signal) gain of the common-emitter amplifier shown in Fig. 1 (Assume, for simplicity, the circuit is biased to $V_C \simeq 0.5\,V_{CC}$). Note that the small signal gain refers to AC-voltages for which above amplifier becomes a grounded-common emitter amplifier. Comment on the role of the quiescent collector current (the DC-current I_C).

3. In order to make the input signal small enough we will use a 100:1 voltage divider in between the signal generator (50 Ω output impedance) and the common emitter amplifier (with the resistance values shown in Fig. 1). Suggest resistor values R_A and R_B of the voltage divider that would work for this purpose and discuss why your choice is reasonable.

[Hint: Show (a) that the resulting AC-voltage is reduced by a factor of 100 and (b) that in this three-stage circuit $Z_{out}^{previous\ stage} \ll Z_{in}^{next\ stage}$ for both cases. Part (b) requires that you calculate the input and the output impedance of the voltage divider as well as the AC-input impedance of the common-emitter amplifier (see example 6, page 16, handout).]