

**American University of Beirut**  
Department of Electrical and Computer Engineering

EECE 310 – Electronics

Fall 2007 – 2008

Homework 10

*In the following problems, assume that in the active region,  $|V_{BE}| = 0.7$  V.*

1. The base current of the transistor shown in Fig. 1 is  $25 \mu\text{A}$ . The BJT has  $\beta = 150$ .

- a) Assume that the BJT is active. Find  $I_E$  and the required value of  $R_B$ .
- b) Find  $V_{CE}$  and verify that the BJT is operating in the active region.
- c) If the emitter of the BJT is grounded, would the transistor remain in the active region? Use the value of  $R_B$  calculated in part (a).

2. The PNP transistor shown in Fig. 2 has  $\alpha = 0.99$ . Find  $R_E$  and  $R_C$  to get  $I_E = 0.1$  mA and  $V_{EC} = 3$  V.

3. For the BJT circuit shown in Fig. 3:

- a) Find the minimum value of the collector voltage, such that the BJT remains in the active region. Assume  $\beta = 150$ .
- b) Find the value of  $R_C$  needed to get a collector voltage half-way between the value calculated in part (a) and  $V_{CC} = +12\text{V}$ .

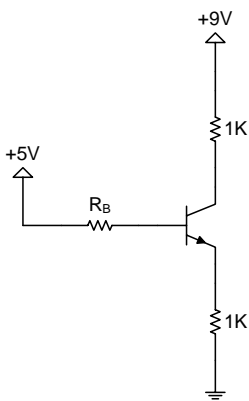


Fig. 1

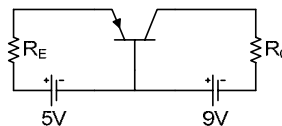


Fig. 2

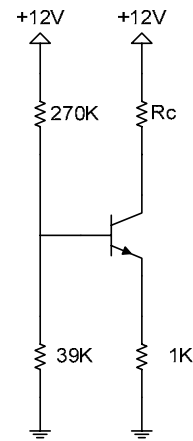


Fig. 3

4. For the circuit shown in Fig. 4, the BJT has  $\beta = 150$ . Assume that  $V_T = 25$  mV and that all capacitors are very large.

- a) Find the DC values of  $I_B$ ,  $I_C$ , and  $V_{CE}$ .
- b) Find the small-signal parameters  $g_m$ ,  $r_{\pi}$ , and  $r_e$ .

- c) Find the small-signal voltage gain of the amplifier,  $v_o/v_i$ .
- d) Find the largest allowable signal swing (peak-to-peak) at the collector to satisfy the two conditions: BJT remains active, and  $v_{be}$  limited to 5 mV. What is the corresponding allowable peak-to-peak input voltage  $v_i$ ?

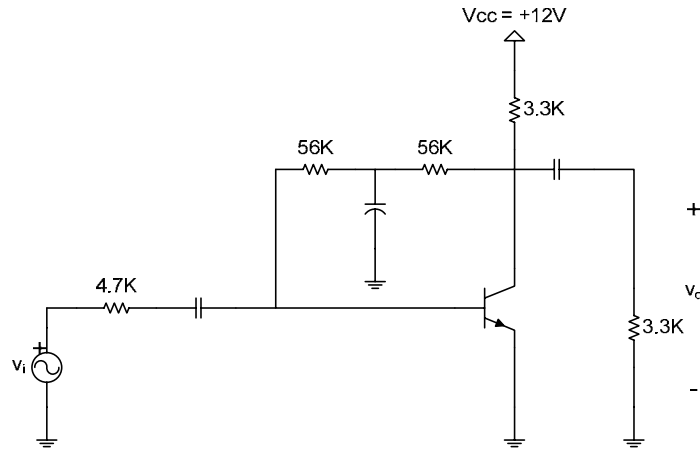


Fig. 4