6.301 Solid State Circuits
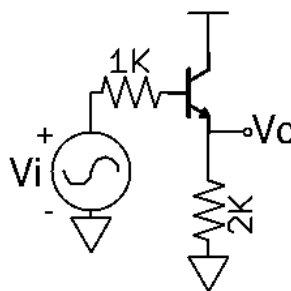

Problem 1: Building Blocks

The AC schematics for four amplifiers are shown below. For each of the amplifiers, find the midband voltage gain and the -3dB frequency using the open-circuit time-constant method. Assume $/beta = 200$, $I_C = 2.5mA$, $c_\pi = 50pF$, and $c_\mu = 2pf$. Neglect r_b and r_o.
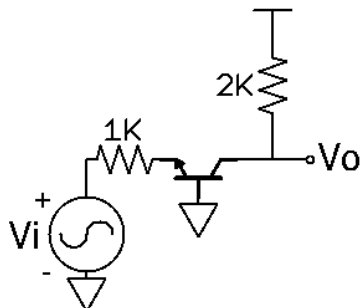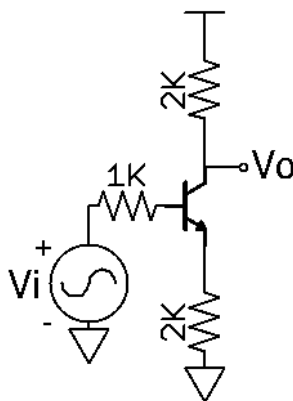
(a) Common Emitter:
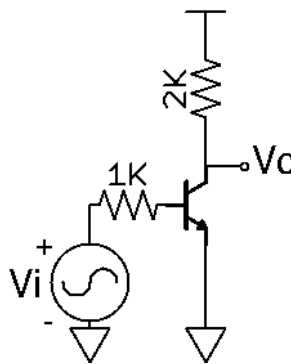
(b) Emitter Follower:

(c) Common Base:

(d) Common Emitter with Emitter Degeneration:

Problem 2: Two-transistor OCTs

For the following CB-CE amplifier, assume $V_{BE} = 0.6v$, $\beta = 200$, $c_\pi = 20pF$, and $c_\mu = 2pF$. Neglect r_b and r_o.

(a) Calculate the midband voltage gain.

(b) Find the -3dB frequency of the amplifier using the OCT method.

Problem 3: Emitter Coupled Pairs

For the two amplifiers shown below, find the midband voltage gain and the -3dB frequency. Why does one have more bandwidth than the other?
You may assume $V_{BE} = 0.6v$, $\beta = 400$, $c_\pi = 40pF$, $c_\mu = 4pF$, and neglect r_b and r_o.

(a) Single-ended Differential Pair

(b) EF-CB