A Multistage Differential BJT Amplifier Simulation

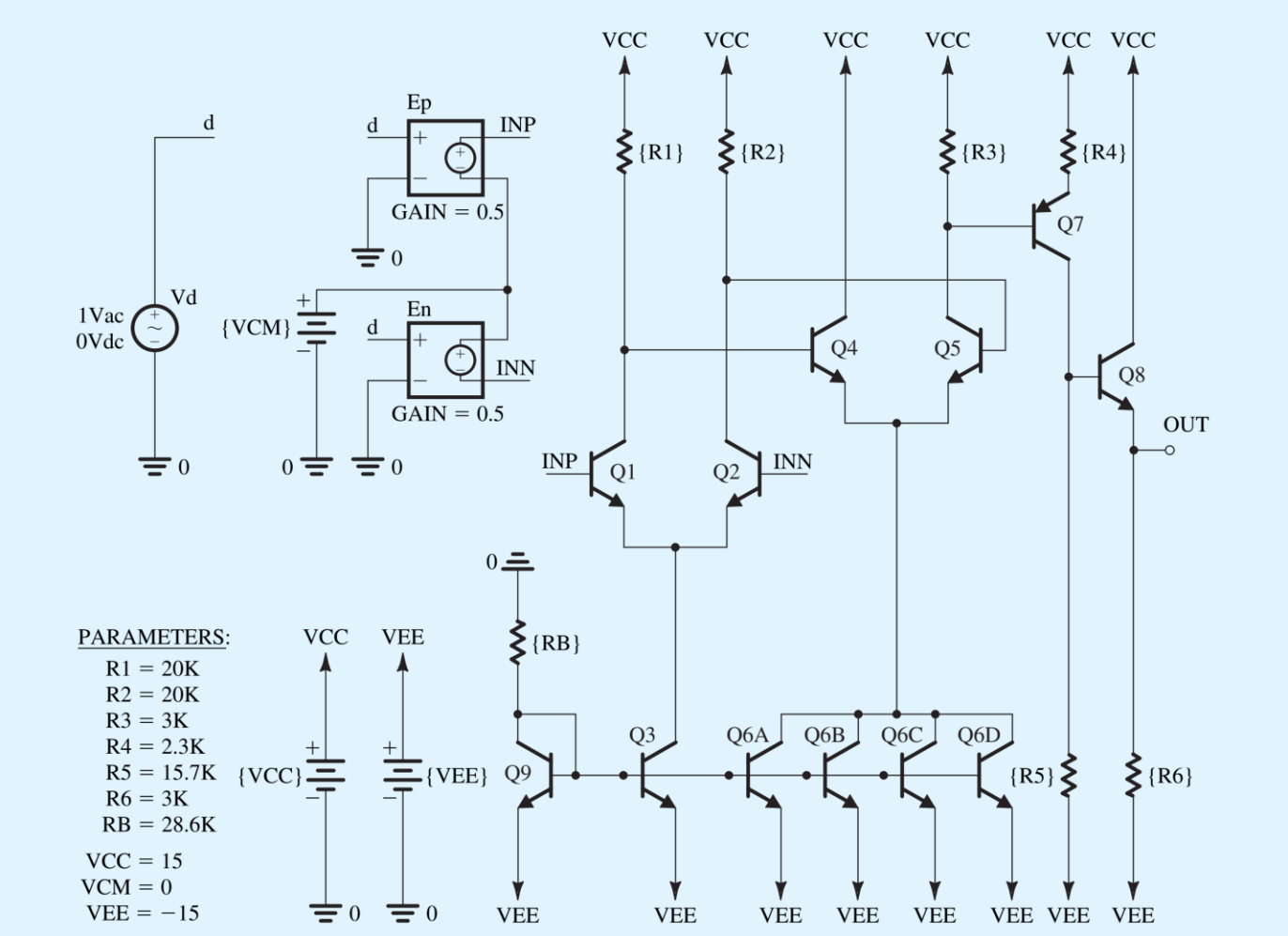


Figure 1 Schematic capture of the op-amp circuit

In this example, we will use parts Q2N3904 and Q2N3906 (from Fairchild Semiconductor) for the npn and pnp BJTs.

Each student should supply a pdf report that has results and an OrCAD project files in .zip format.

- **construct the circuit shown in Figure-1.**

In OrCAD, the common-mode input voltage $\mathbf{V_{CM}}$ of the op-amp circuit is set to 0 V (i.e., to the average of the dc power-supply voltages $\mathbf{V_{CC}}$ and $\mathbf{V_{EE}}$) to maximize the available input signal swing. **A bias-point** simulation is performed to determine the dc operating point.

- **Construct a table that shows the collector current for each transistor.**

To compute the large-signal differential transfer characteristic of the op-amp circuit, we perform a **dc-analysis simulation** in PSpice with the differential voltage input $\mathbf{V_d}$ swept over the range $\mathbf{-V_{EE}}$ to $\mathbf{+V_{CC}}$, and we plot the corresponding output voltage $\mathbf{V_{OUT}}$.

- **Plot the resulting dc transfer characteristic.**

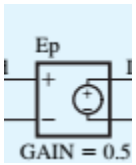
Repeat **dc analysis** is with $\mathbf{V_d}$ swept over the range −5mV to +5mV at increments of 10 μV.

- **Plot the resulting differential dc transfer characteristic. What is the gain of op-amp?**

To compute the **frequency response** of the op-amp circuit and to measure its differential gain $\mathbf{A_d}$ and its 3-dB frequency $\mathbf{f_H}$ in OrCAD, we set the differential input voltage $\mathbf{V_d}$ to be a 1-V ac signal (with 0-V dc level), perform an **ac-analysis simulation**.

- **Plot the output voltage magnitude $\mathbf{V_{OUT}}$ versus frequency.**

Notes:



This voltage controlled voltage source that can be found in OrCAD under **ANALOG lib** with name **E.**