

# Lecture 10

---

## ANNOUNCEMENTS

- Alan Wu will hold an extra lab session tomorrow (9/28), 2-4PM
- The post-lab assignment for Experiment #4 has been shortened!
- 2 pgs of notes (double-sided, 8.5"×11") allowed for Midterm #1

## OUTLINE

- BJT Amplifiers (cont'd)
  - CB stage with biasing
  - Emitter follower (Common-collector amplifier)
    - Analysis of emitter follower core
    - Impact of source resistance
    - Impact of Early effect
    - Emitter follower with biasing

Reading: Chapter 5.3.3-5.4

# Biasing of CB Stage

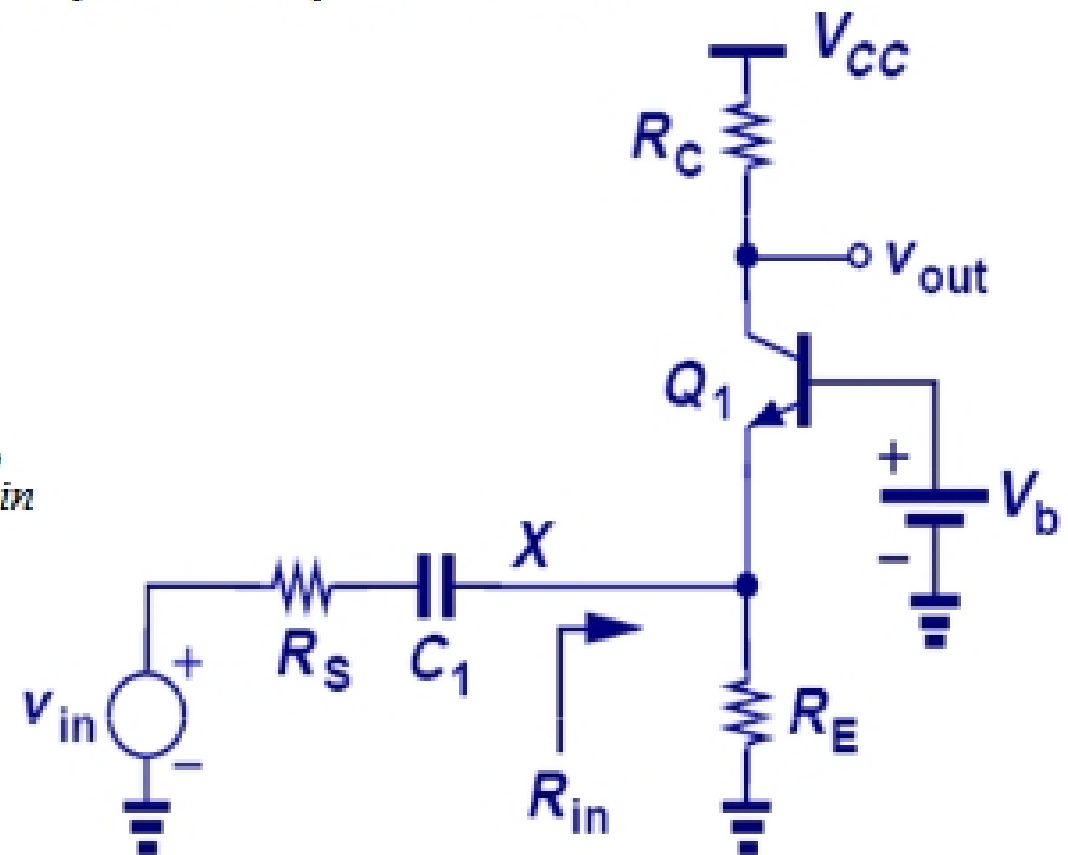
- $R_E$  is necessary to provide a path for the bias current  $I_E$  to flow, but it lowers the input impedance.

$$R_{in} = \frac{1}{g_m} \parallel R_E = \frac{\frac{1}{g_m} \cdot R_E}{\frac{1}{g_m} + R_E} = \frac{R_E}{1 + g_m R_E}$$

$$v_X = \frac{R_{in}}{R_{in} + R_S} v_{in} = \frac{R_E}{R_E + (1 + g_m R_E) R_S} v_{in}$$

$$A_v \equiv \frac{v_{out}}{v_{in}} = \frac{v_{out}}{v_X} \cdot \frac{v_X}{v_{in}}$$

$$\frac{v_{out}}{v_{in}} = g_m R_C \cdot \frac{R_E}{R_E + (1 + g_m R_E) R_S}$$



# Reduction of Input Impedance Due to $R_E$

- The reduction of input impedance due to  $i_1$  is undesirable because it shunts part of the input current to ground instead of to  $Q_1$  (and  $R_C$ ).

→ Choose  $R_E \gg 1/g_m$ , i.e.  $I_C R_E \gg V_T$

