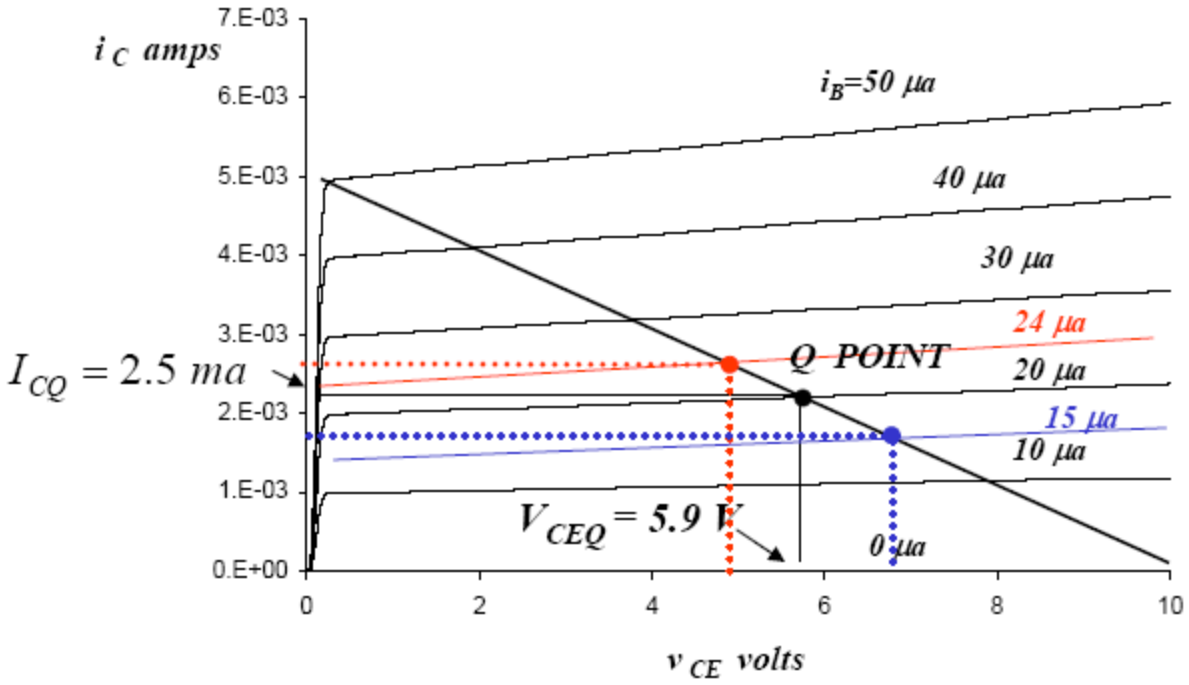
# Lecture 18

BJT

# AC Characteristics-Collector Circuit



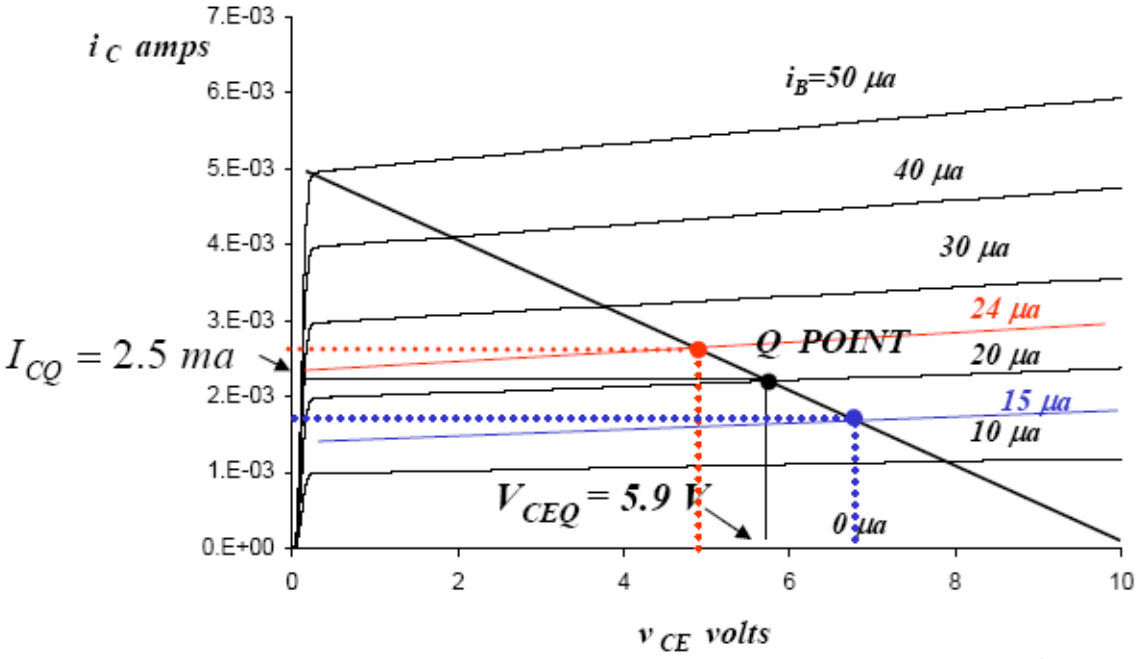

Using these max and min values for the base current on the collect circuit load line, we find:

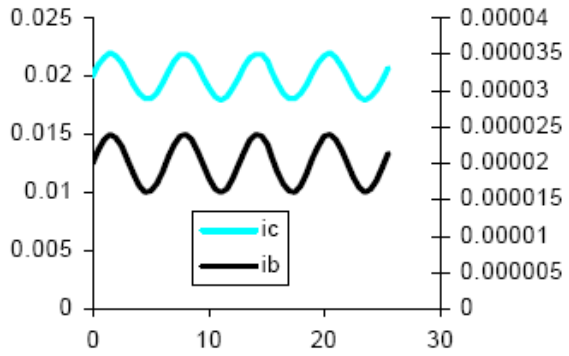
At Max Input Voltage: $V_{CE}$ = 5 V, $i_C$ = 2.7mA

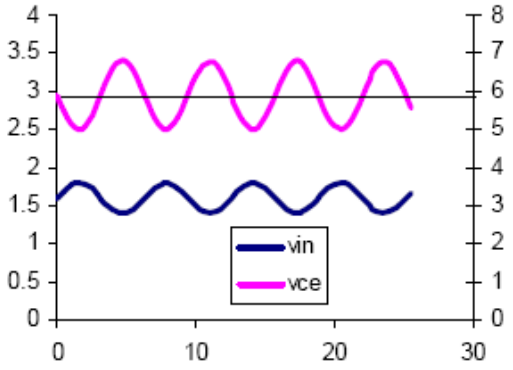
At Min Input Voltage: $V_{CE}$ = 7 V, $i_C$ = 1.9mA

Recall: At Q-point: $V_{CE}$ = 5.9 V, $i_B$ = 2.5ma

# AC Characteristics-Collector Circuit



# BJT AC Analysis - Amplifier Gains

From the values calculated from the base and collector circuits we can calculate the amplifier gains:

- $\beta = 125$
- Current gain $= \Delta i_c / \Delta i_b = (2.7 - 1.9)\text{m} / (24 - 15)\ \mu$
  $= .8/9*10^3 = 88.9$
- Voltage gain $= V_o / V_i = \Delta V_{CE} / \Delta V_{BE}$
  $= (5 - 7) / (.63 - .59) = -2/0.04 = -50$
- Voltage gain $= V_o / V_s = \Delta V_{CE} / \Delta V_{in}$
  $= (5 - 7) / .4 = -2 / .4 = -5$

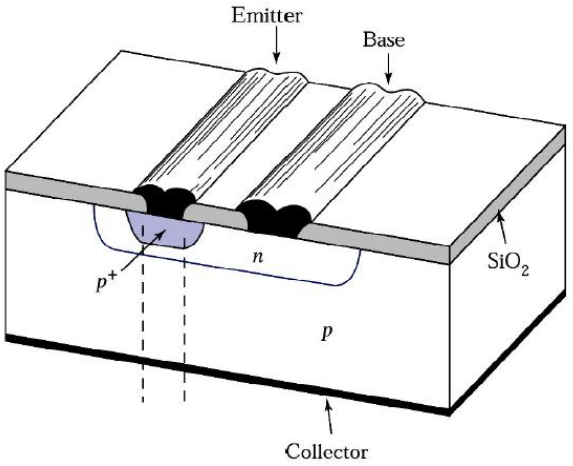
# BJT AC Analysis - Summary

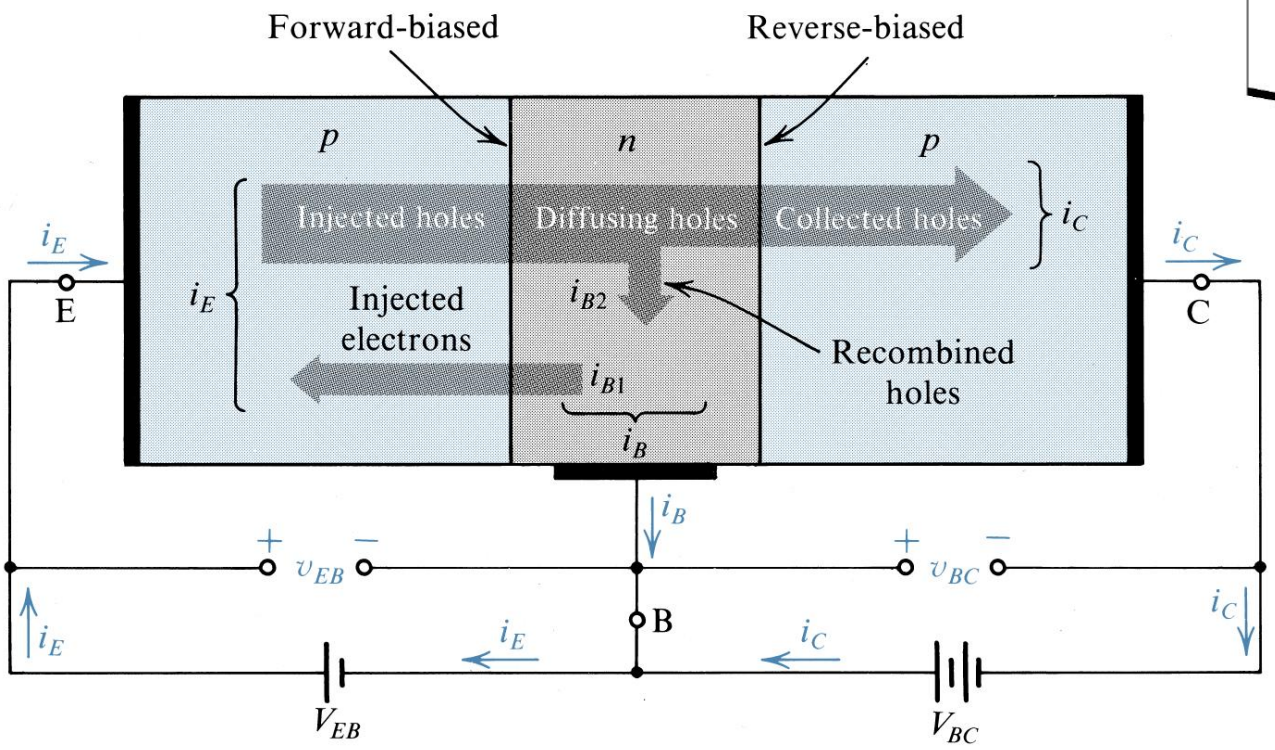
- Once we complete DC analysis, we analyze the circuit from an AC point of view.
- AC analysis can be performed via a graphical processes
  - Find the maximum and minimum values of the input parameters (e.g., base current for a BJT)
  - Use the transistor characteristics to calculate the output parameters (e.g., collector current for a BJT).
- Calculate the gains for the amplifier

# The pnp Transistor

- Basically, the *pnp* transistor is similar to the *npn* except the parameters have the opposite sign.
  - The collector and base currents flows out of the transistor; while the emitter current flows into the transistor
  - The base-emitter and collector-emitter voltages are negative
- Otherwise the analysis is identical to the *npn transistor.*

# The PNP Transisto




Current flow in a pnp transistor biased to operate in the active mode.

# The pnp Transistor

- Two junctions
  - Collector-Base and Emitter-Base
- Biasing
  - $v_{BE}$ Forward Biased
  - $v_{CB}$ Reverse Biased