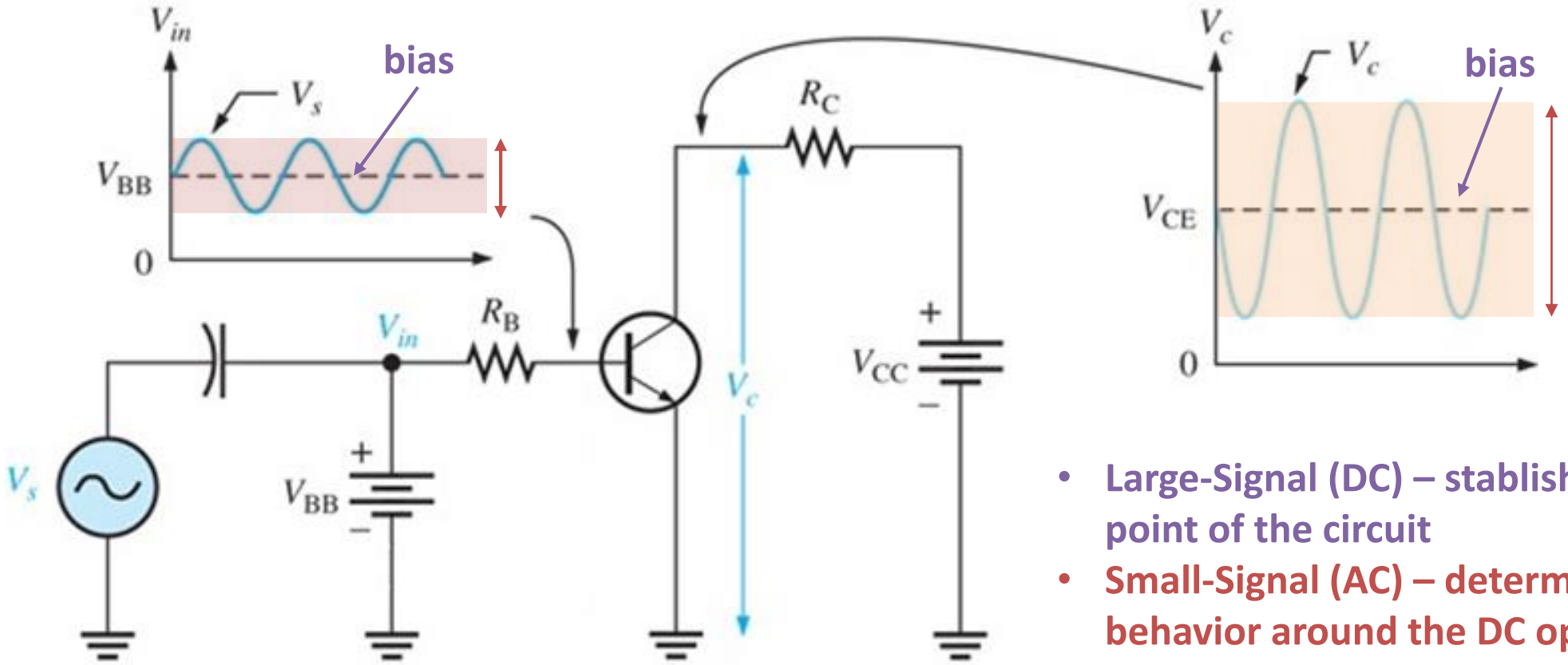
Last Lecture → AC / DC Behavior

10/4/2019

- **Bias current is stablished through V_{BB} and supplied by V_{cc}**
- **AC signal is coupled through the capacitor and superimposed to the DC signal**



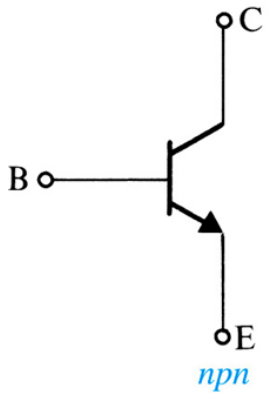
AC & DC analysis can be performed via superposition!

- **Large-Signal (DC) – stablishes the DC operating point of the circuit**
- **Small-Signal (AC) – determines de circuit behavior around the DC operating point**

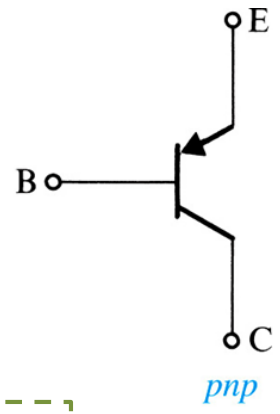
Last Lecture → Small Signal Circuit

10/4/2019

- **npn transistor**

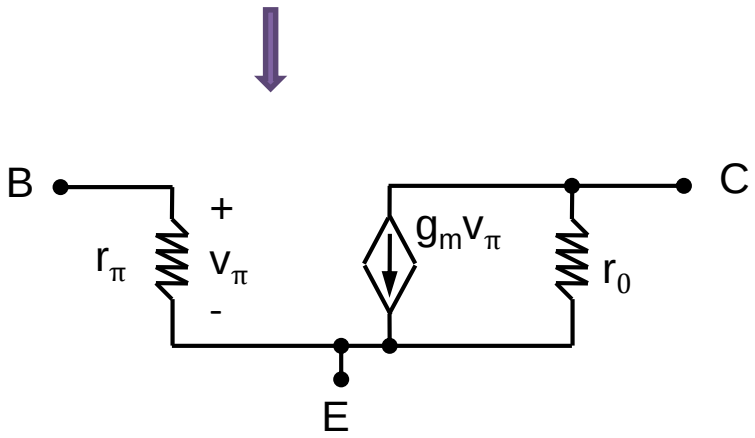


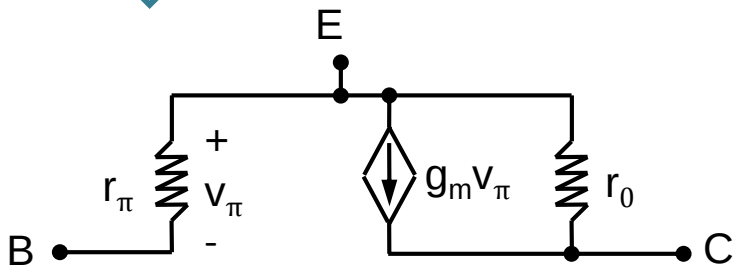
- **pnp transistor**



Analysis Procedure

1) Determine the transistor bias current (DC Analysis)
2) Determine the small-signal parameters
3) Draw the small-signal equivalent circuit
   - All DC sources off!
   - Low freq. cap shorted!
4) Replace transistor with small-signal circuit
5) Calculate the desired specifications





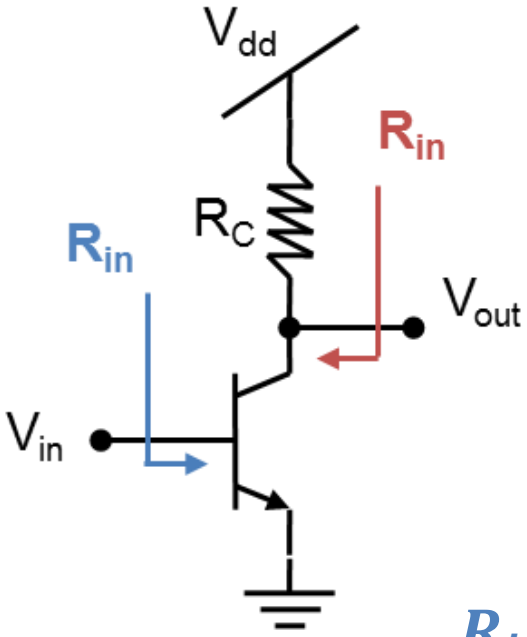
Small Signal Parameters

$$g_m = \frac{I_C}{V_T} \qquad r_0 = \frac{V_A}{I_C}$$

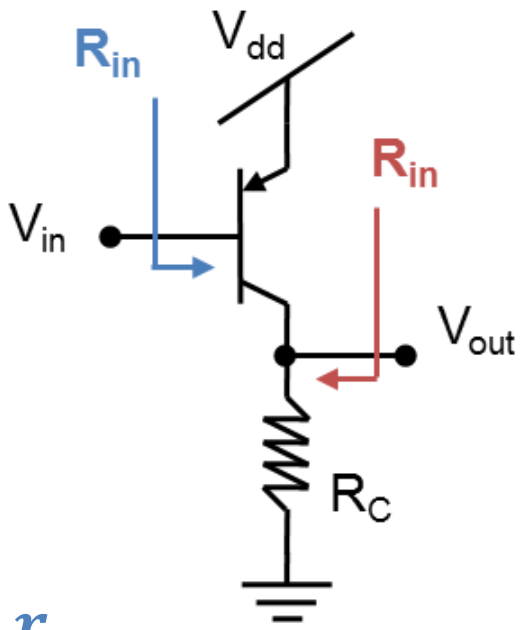
$$r_\pi = \frac{\beta}{g_m}$$

Last Lecture → Common-Emitter Amplifier

- ***npn***



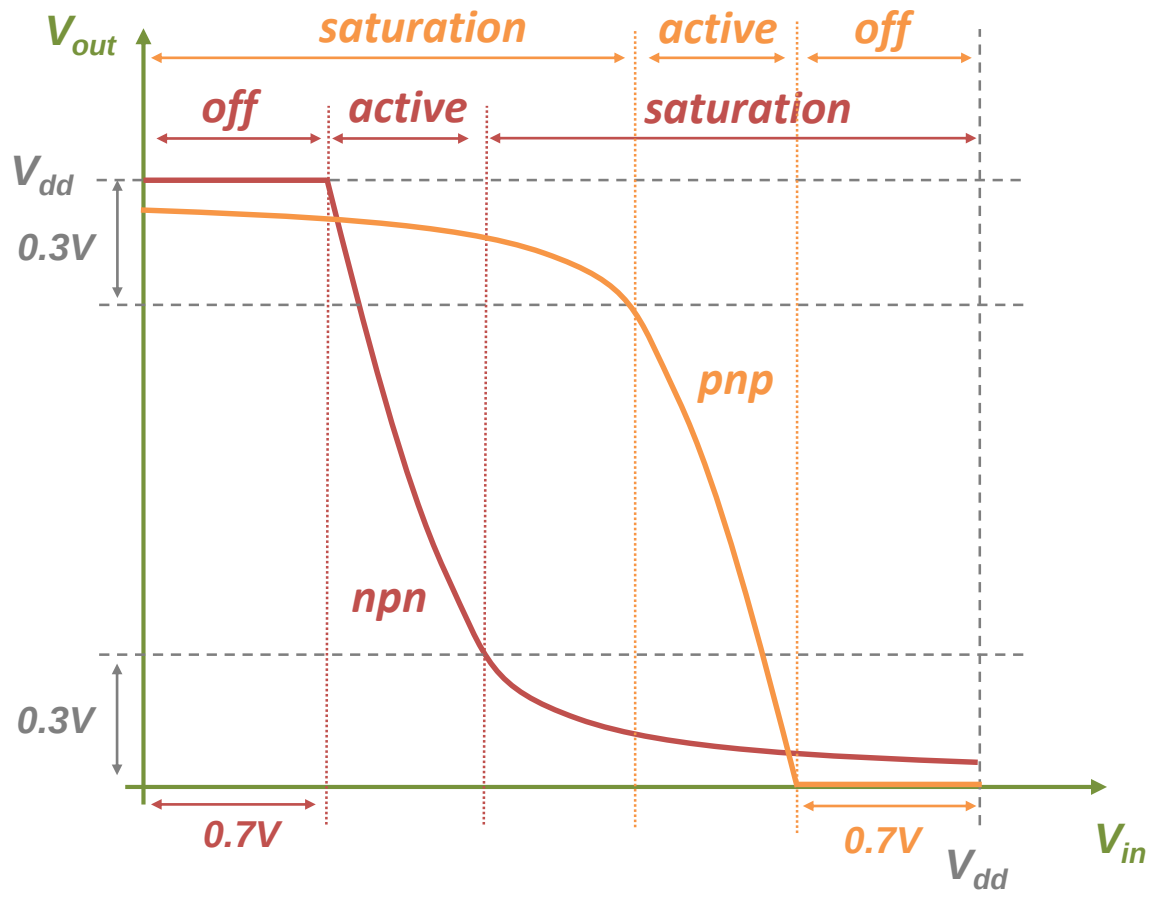
- ***pnp***



$$R_{in} = r_\pi$$

$$R_{out} = R_c // r_0$$

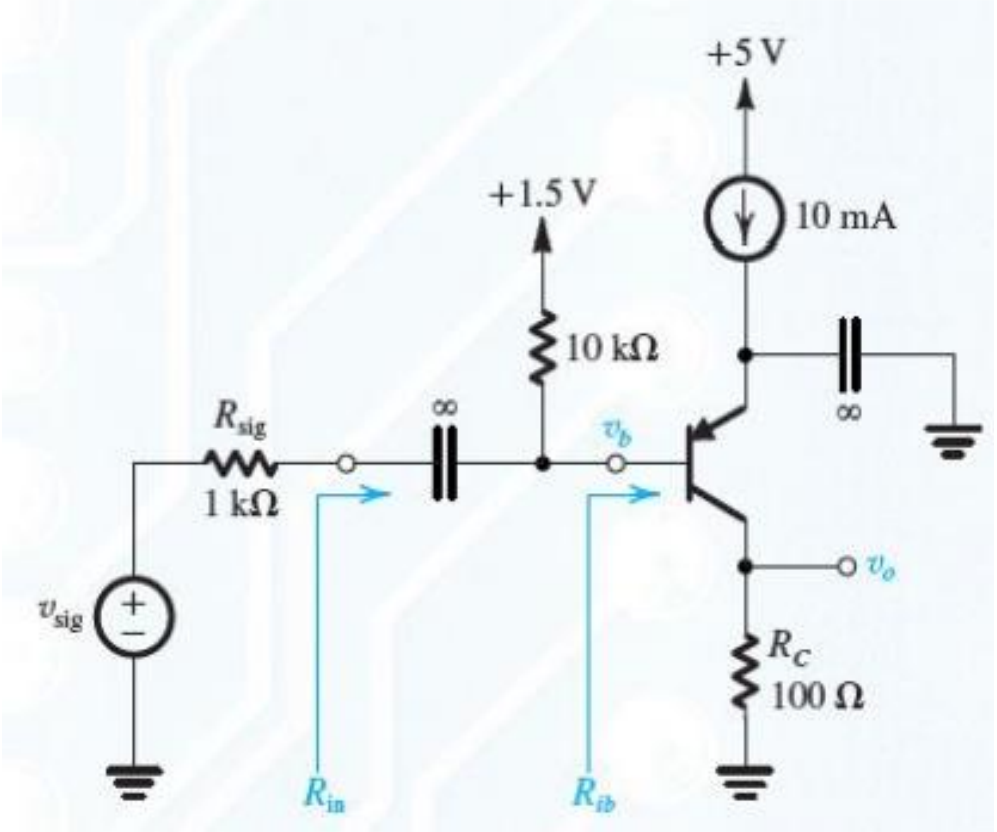
$$A_V = -g_m(R_c // r_0)$$



Problem 6.101

10/4/2019

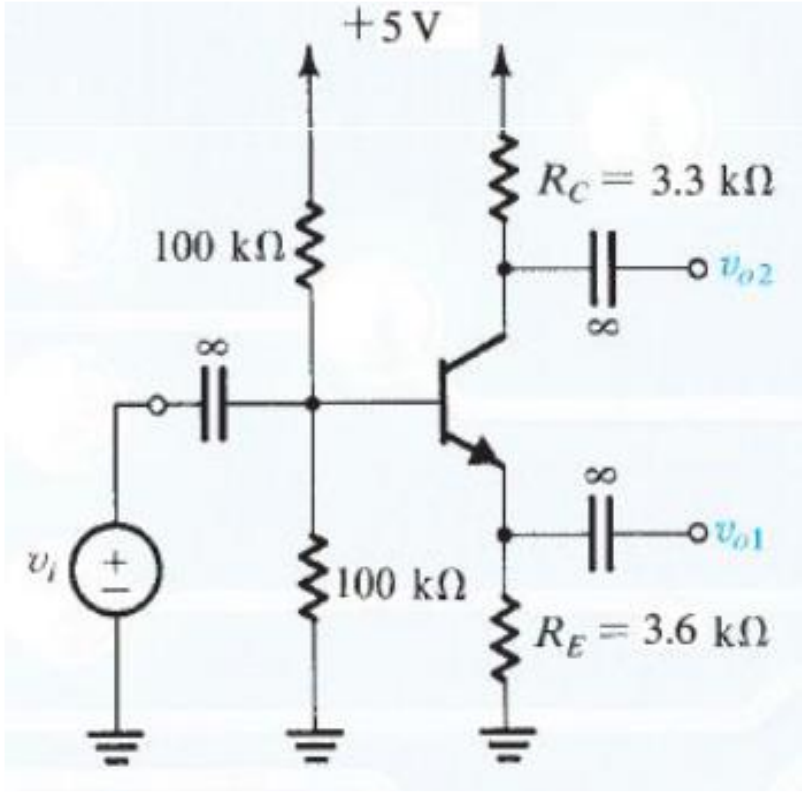
Assuming β = 200, and $V_A=\infty$, find I_c and the dc voltage at the collector. Find the input resistances R_{ib} and R_{in} and the overall voltage gain v_o/v_{sig}.



Problem 6.107

10/4/2019

Assuming β is very large and the transistor is operating in active mode, find the collector bias current I_C. Using the small-signal model analyze the circuit to determine v_{01}/v_i and v_{02}/v_i. Determine the resistance seen by the input source ($V_A=\infty$) and the output resistances from v_{01} and v_{02} ($V_A=100V$).



$$V_E = {V_{cc}}/{2} - V_{BE} = 1.8V$$

$$V_C = V_{cc} - R_C \cdot I_C = 3.35V$$

$$I_c = I_E = \frac{V_E}{R_E} = 0.5mA$$