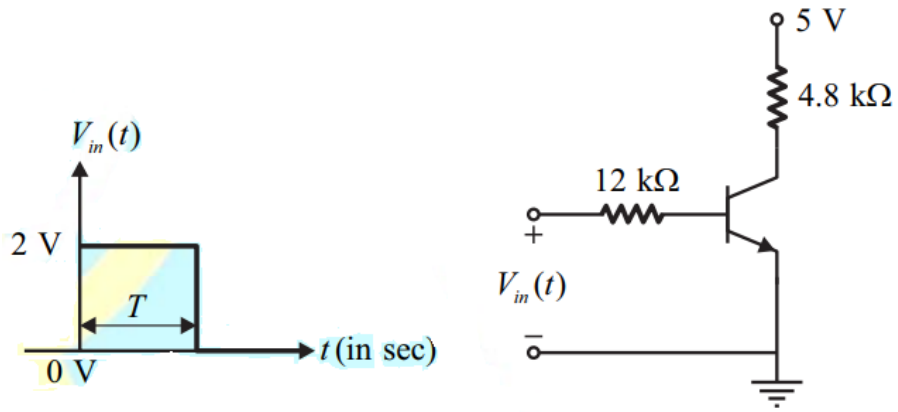
Tutorial III

Indian Institute of Technology Roorkee
Department of Electronics and Communication Engineering
EC-101: Fundamentals of Electronics, Autumn 2024

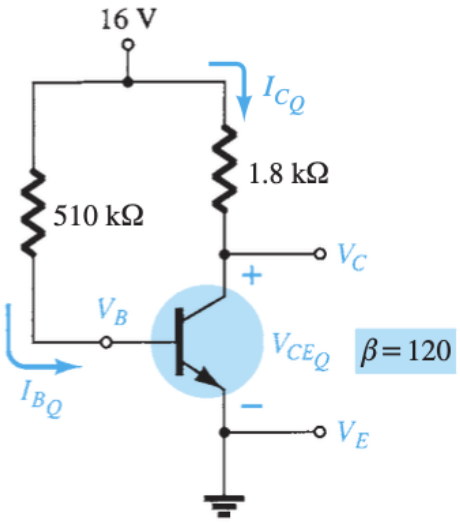
1. **Question:** In the figure shown, the n-p-n transistor acts as a switch



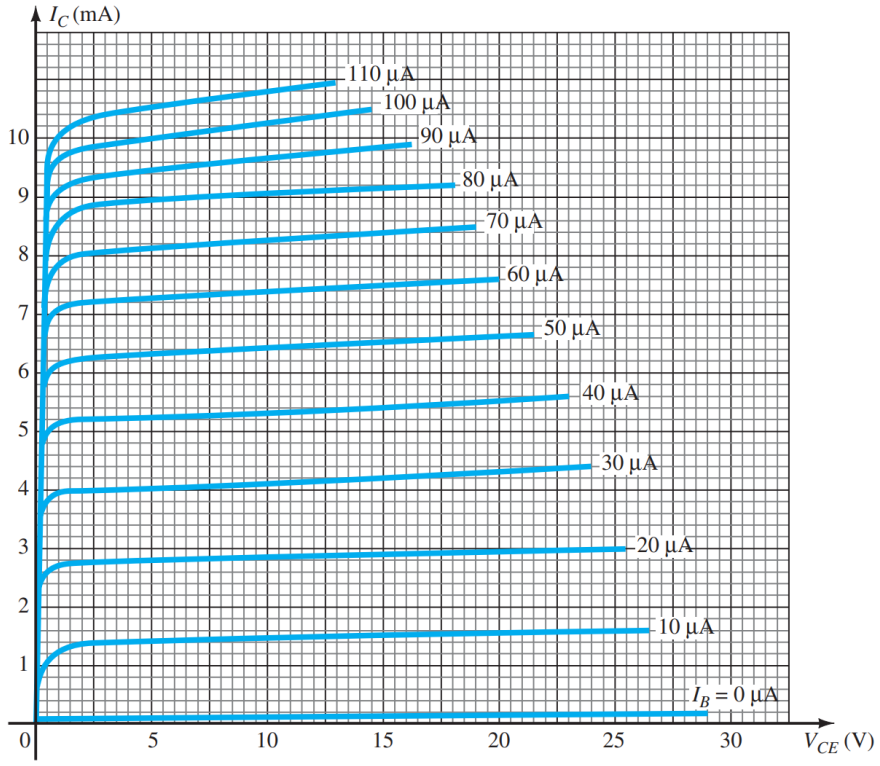
For the input V_{in} as shown in the figure, the transistor switches between the cutoff and saturation regions of operation, when T is large. Assume collector-to-emitter voltage at saturation $V_{CE(sat)} = 0.2$ V and base-to-emitter voltage $V_{BE} = 0.7$ V. What is the minimum value of the common-base current gain (α) of the transistor for the switching should be?

2. **Question:** For the fixed-bias configuration, determine:

   (a) I_{B_Q}
   (b) I_{C_Q}
   (c) V_{CE_Q}
   (d) V_C
   (e) V_B
   (f) V_E



3. **Question:** Given the BJT transistor characteristics of Fig:



a. Draw a load line on the characteristics determined by $E = 21\,\text{V}$ and $R_C = 3\,\text{k}\Omega$ for a fixed-bias configuration.

b. Choose an operating point midway between cutoff and saturation. Determine the value of R_B to establish the resulting operating point.

c. What are the resulting values of I_{CQ} and V_{CEQ}?

d. What is the value of β at the operating point?

e. What is the value of α defined by the operating point?

f. What is the saturation current ($I_{C_{\text{sat}}}$) for the design?

g. What is the DC power dissipated by the device at the operating point?

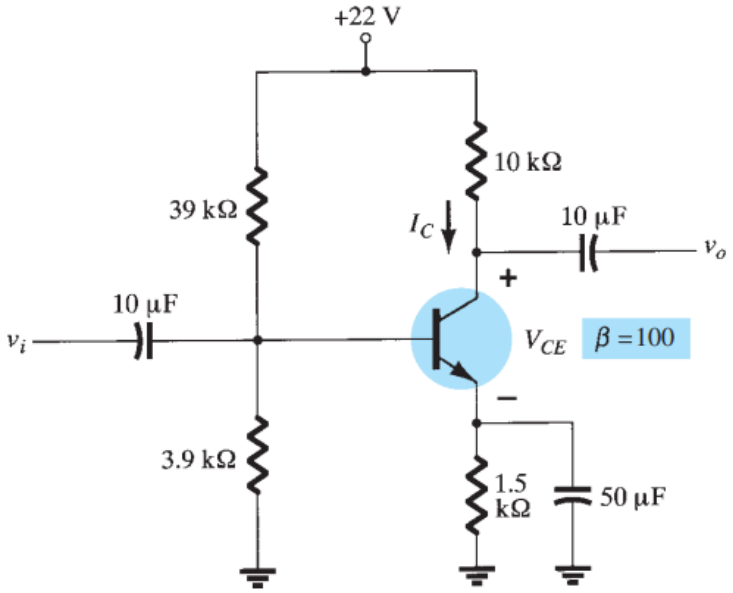
h. What is the power supplied by V_{CC}?

i. Determine the power dissipated by the resistive elements by taking the difference between the results of parts (g) and (h).

4. **Question:**

(a) Determine the dc bias voltage V_{CE} and the current I_C for the voltage divider configuration of Fig:

(b) Repeat the exact analysis if β is reduced to 50, and compare solutions for I_{CQ} and V_{CEQ}



5. **Question:** Given the information provided in Figure, Determine the following:

a. R_C

b. R_E

c. R_B

d. V_{CE}

e. V_B