# SNS COLLEGE OF TECHNOLOGY

**(An Autonomous Institution)**

**COIMBATORE-35**

**Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade**
**Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai**

## DEPARTMENT OF BIOMEDICAL ENGINEERING

## COURSE NAME: 19EIB201/ ELECTRONIC DEVICES

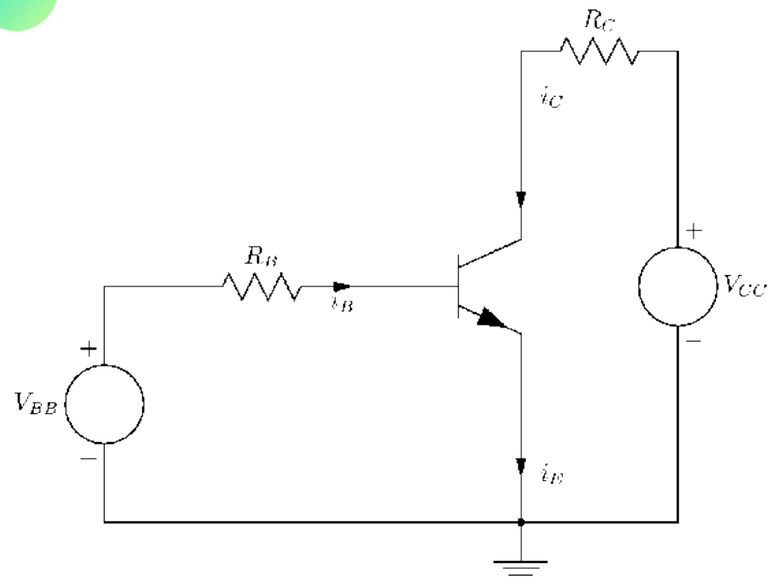
II YEAR / III SEMESTER

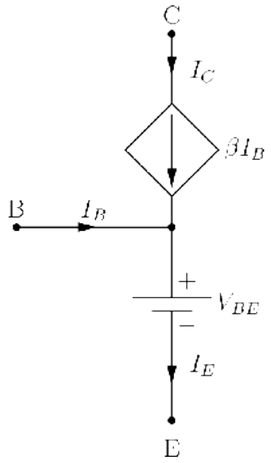
Unit 3– Small Signal Amplifier

Topic 2: Transistor as Amplifier

# DC Model and Parameters

- Consider the CE configuration of transistor for analysis.




$$\beta = \frac{I_C}{I_B}.$$

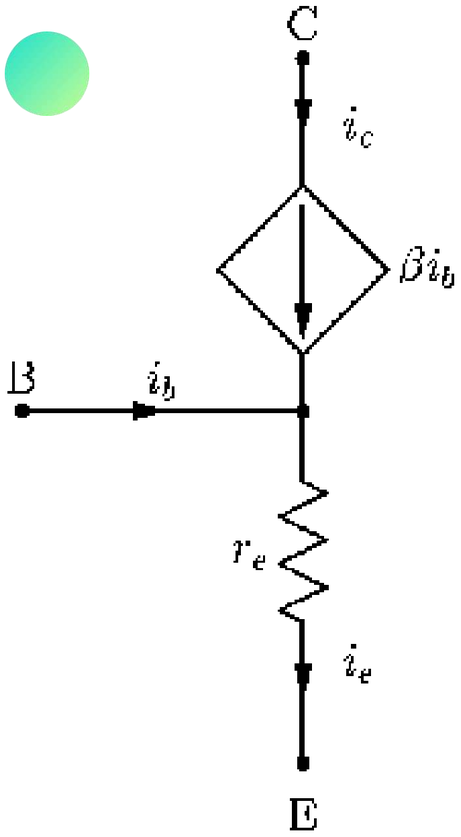
$$\alpha = \frac{I_C}{I_E}.$$

Common value would be around 0.99

$$\beta = \frac{\alpha}{1-\alpha}.$$

Common values would be around 20 to 400

# AC Model Parameters



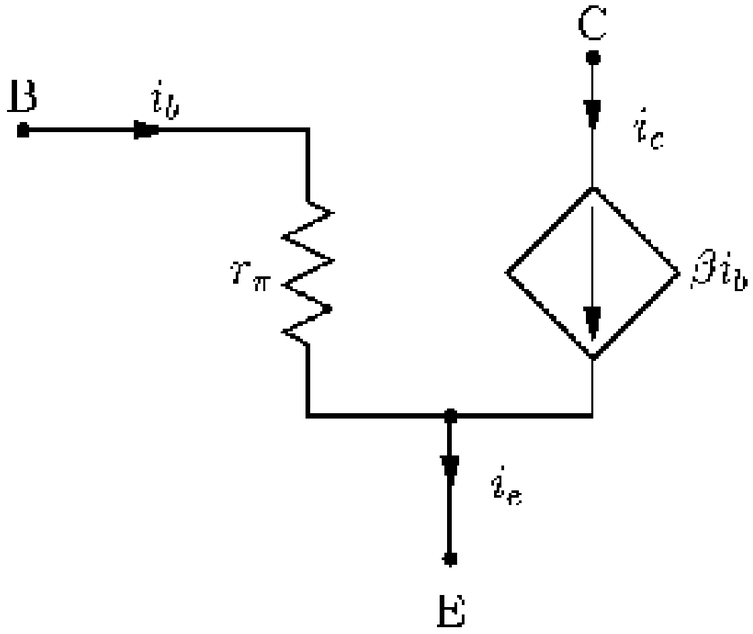

$$i_c = \beta i_b.$$

$$i_c = \alpha i_e.$$

$$i_e = i_b + i_c$$

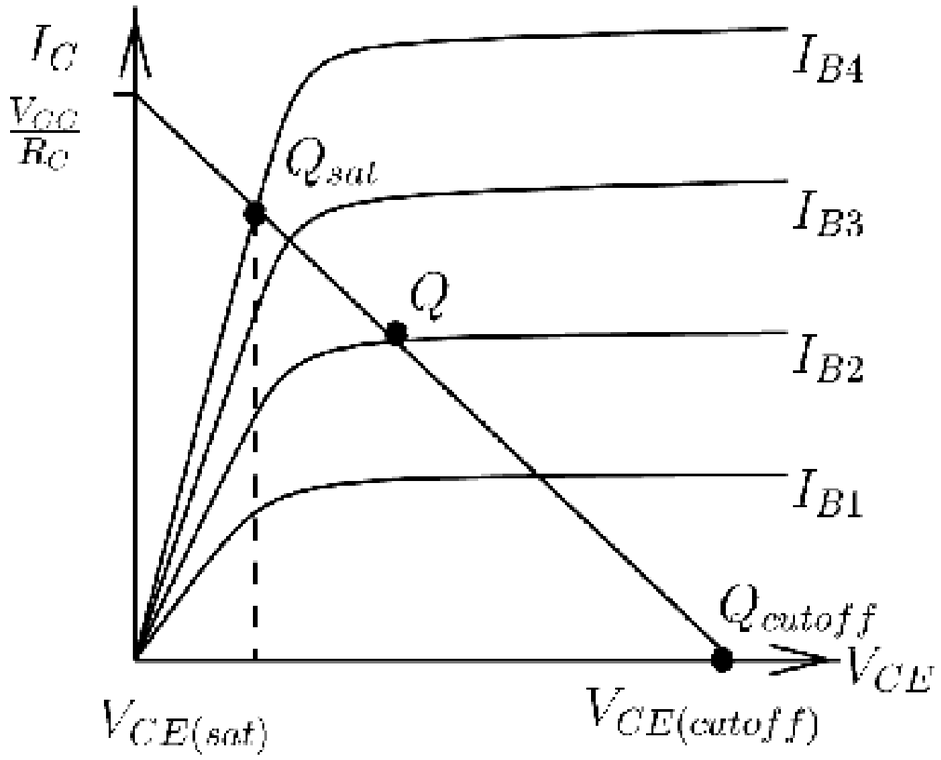
$$r_e = \frac{0.025}{I_E}\ \Omega$$

$$r_\pi = (\beta + 1) r_e$$



# BJT Circuit – DC Analysis

$$V_{BE} = 0.7\ V, \quad I_C = \beta I_B, \quad I_E = I_B + I_C$$




The left part of the circuit gives, using KVL,

$$V_{BB} = I_B R_B + V_{BE}$$

$$I_B = \frac{V_{BB} - 0.7\ V}{R_B}.$$

The right part of the circuit gives

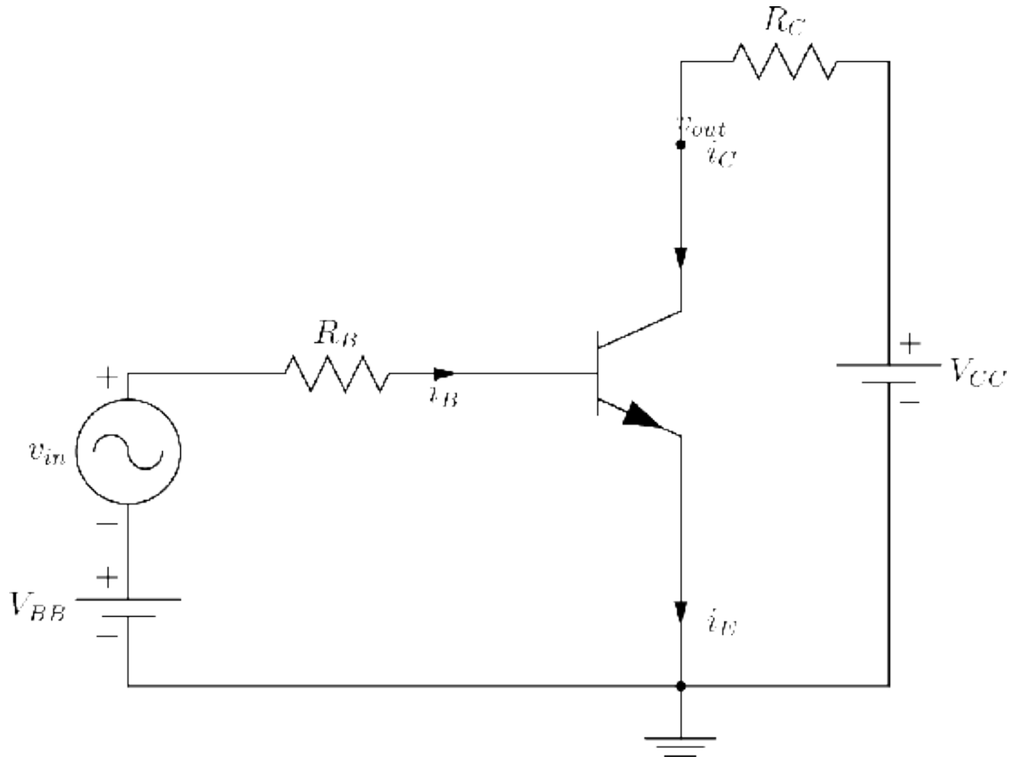
$$V_{CC} = I_C R_C + V_{CE}$$

$$I_C = \frac{V_{CC} - V_{CE}}{R_C}$$

one can solve for $V_{CE}$ to find the ***quiescent*** or ***operating point*** $Q$.

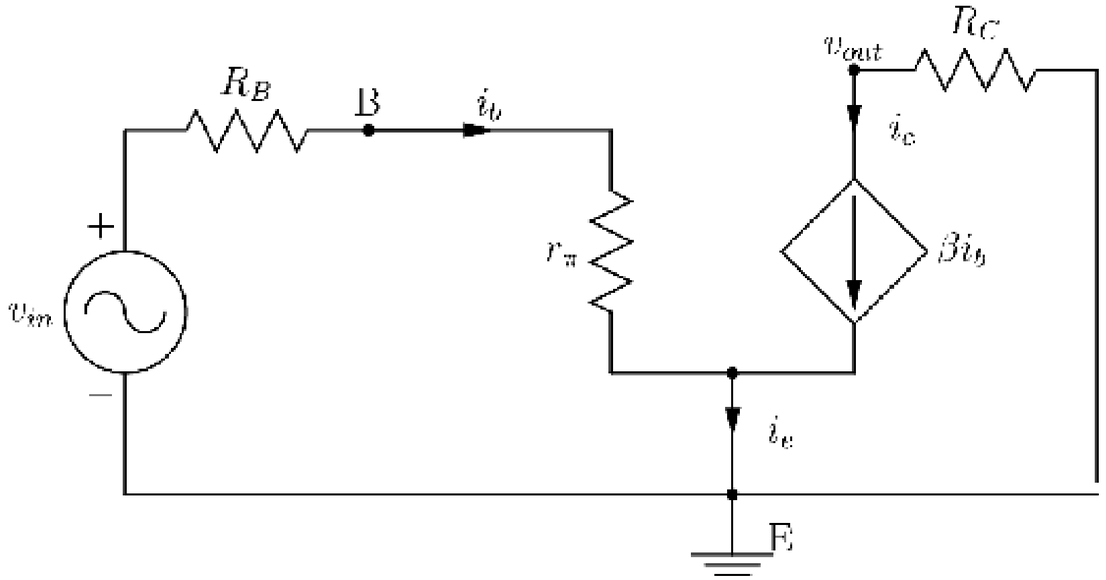
# The Transistor as an Amplifier

When the DC operating point *Q* is in the active region, the transistor can act as an amplifier to AC signals. For such purpose, *Q* should be set midway between $Q_{sat}$ and $Q_{cutoff}$ to allow for the maximum possible voltage excursions.



# The Transistor as an Amplifier

It is convenient to re-draw the circuit showing only the AC signals. Here, the DC sources have been zeroed out; the AC component does not see them.




$$v_{in} = i_b(R_B + r_\pi)$$

$$i_b = \frac{v_{in}}{R_B + r_\pi} = \frac{v_{in}}{R_B + (\beta + 1)r_e}.$$

$v_c = - i_c R_C$

$$v_c = -\beta R_C i_b.$$

$$v_c = -\frac{\beta R_C}{R_B + (\beta + 1)r_e} v_{in}.$$

the input voltage $v_{in}$ is amplified at the output (i.e. collector voltage $v_c$) by a gain factor

$$A = -\frac{\beta R_C}{R_B + (\beta + 1)r_e}$$

# SUMMARY

# ASSESMENT

Dear student,

Quiz is posted in your Google class room

Allotted time for quiz is 5 min

No of Questions is 10

KEEP
LEARNING..

# Thank u

SEE YOU IN NEXT CLASS