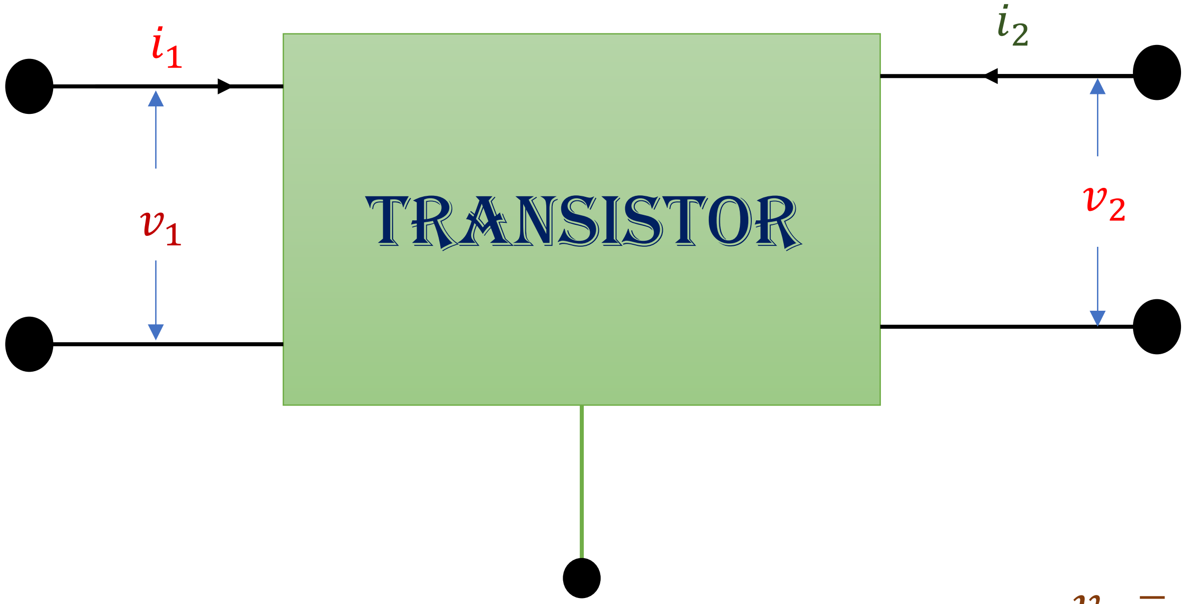
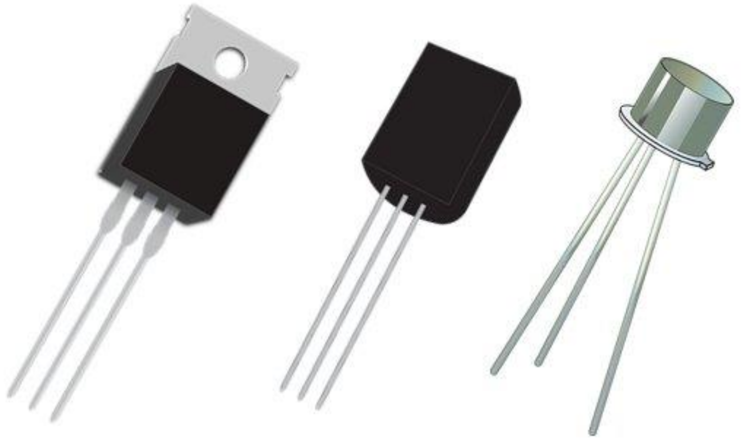
- # Transistor as a Four Pole -





સ્વતંત્ર ચલો - i_1 , v_2 અને આધારિત ચલો - i_2 , v_1

$$v_1 = f(i_1 , v_2) \quad \& \quad i_2 = f(i_1 , v_2)$$

$$dv_1 = \left(\frac{\partial v_1}{\partial i_1}\right) di_1 + \left(\frac{\partial v_1}{\partial v_2}\right) dv_2$$

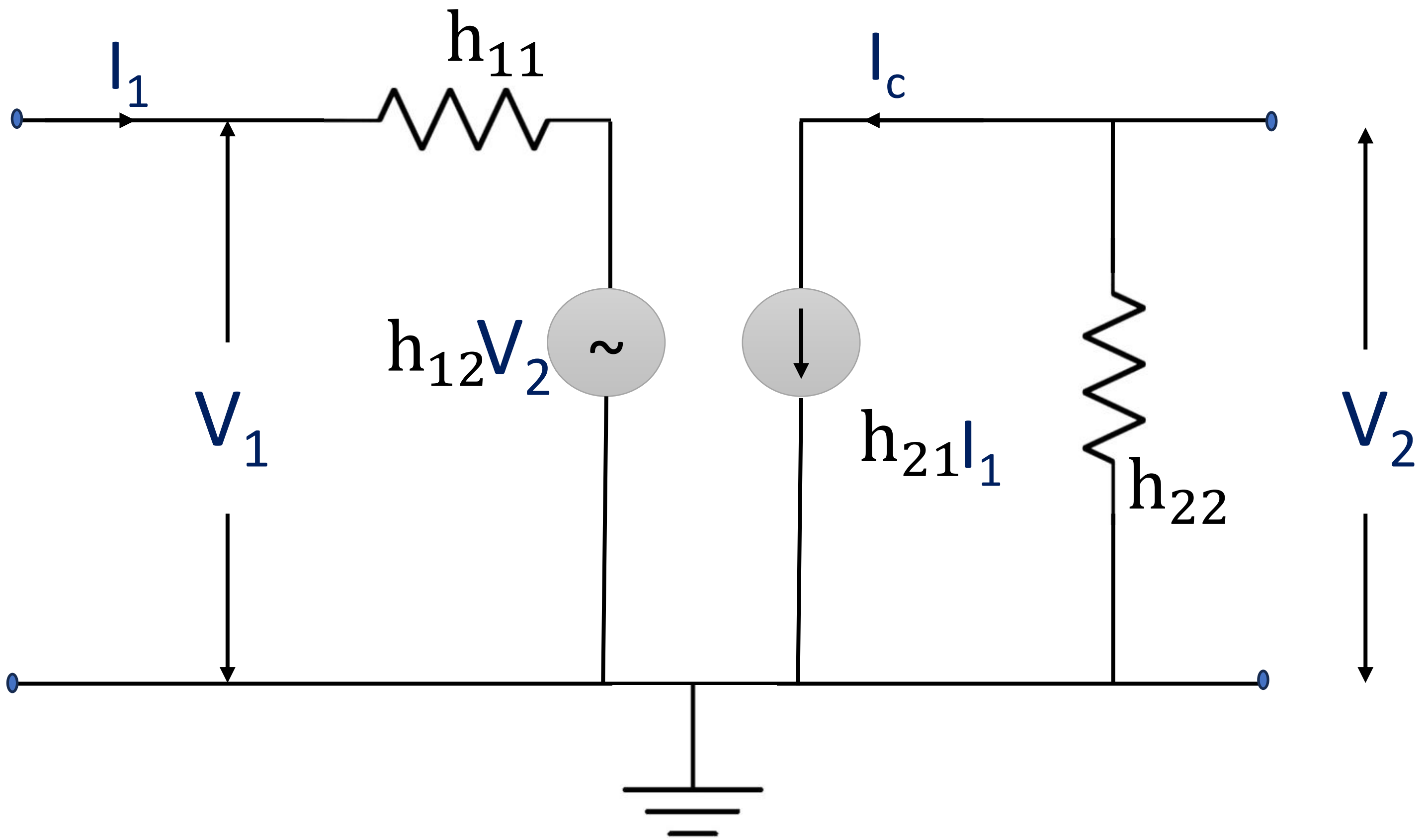
$$di_2 = \left(\frac{\partial i_2}{\partial i_1}\right) di_1 + \left(\frac{\partial i_2}{\partial v_2}\right) dv_2$$

$$v_1 = h_{11}\, i_1 + h_{12} v_2$$

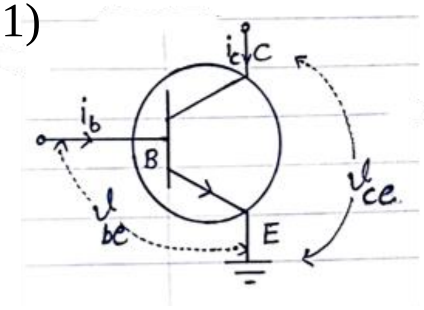
$$i_2 = h_{21} i_1 + h_{22} v_2$$

- Input Impedance - h_{11} - h_i
- Reverse Voltage Ratio - h_{12} - h_r
- Forword Current Ratio- h_{21} - h_f
- Output Admittance - h_{22} - h_o

- **હાઈબ્રીડ મોડેલનો સરળ h-પ્રાચલ પરિપથ -**



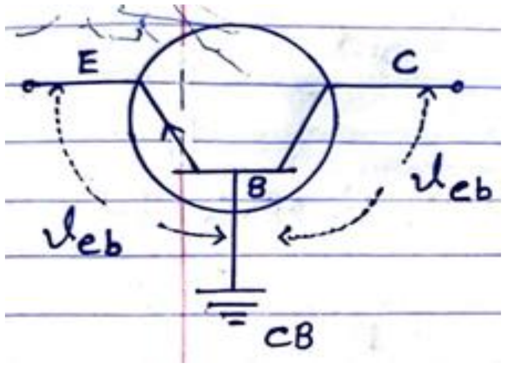
(1)



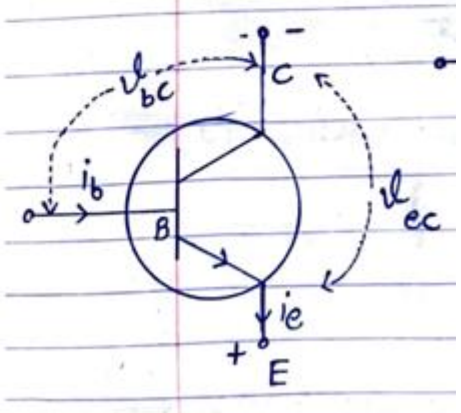
$v_{be} = h_{ie} i_b + h_{re} v_{ce}$

$i_c = h_{fe} i_b + h_{oe} v_{ce}$

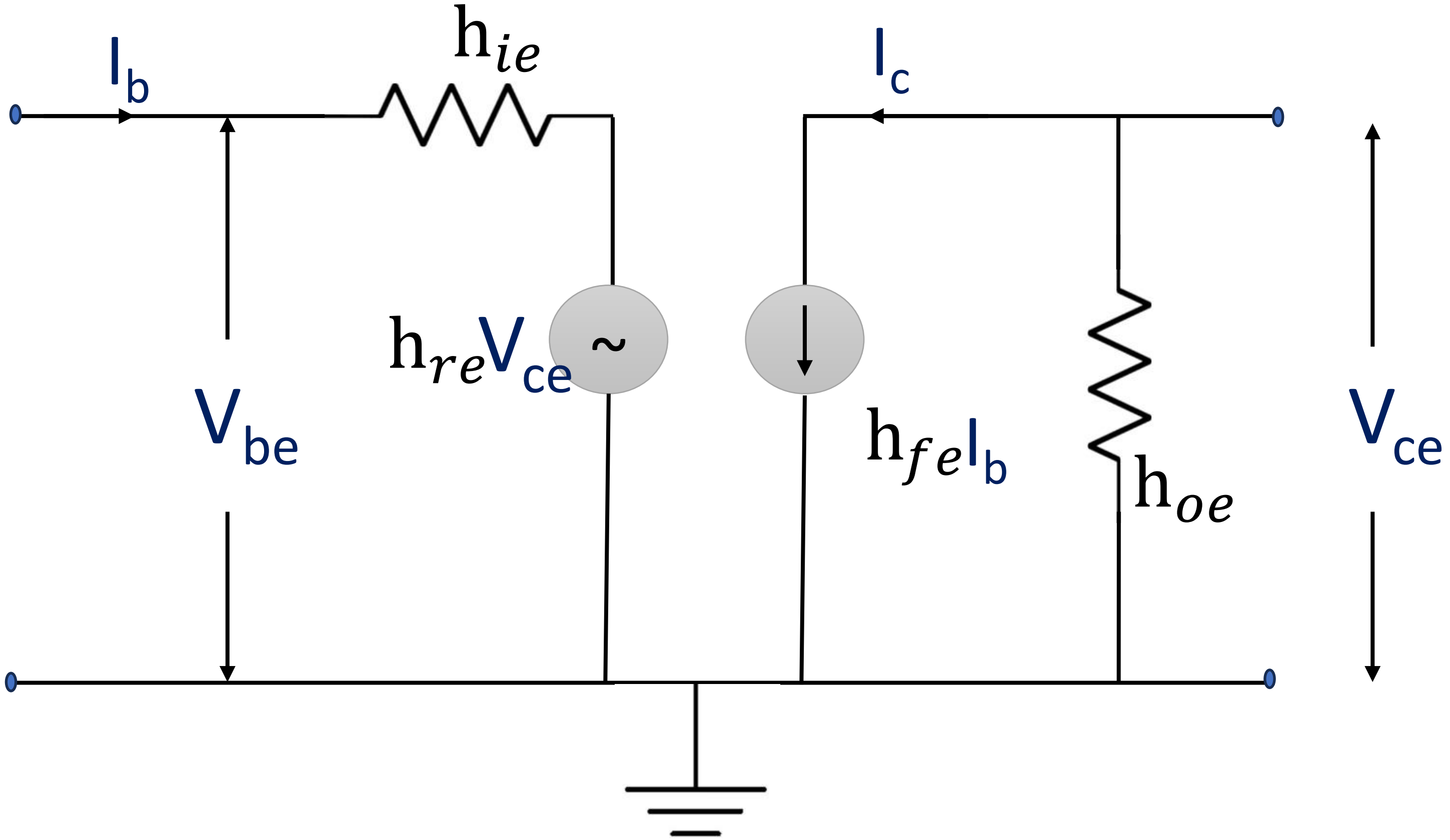
(2)



(3)

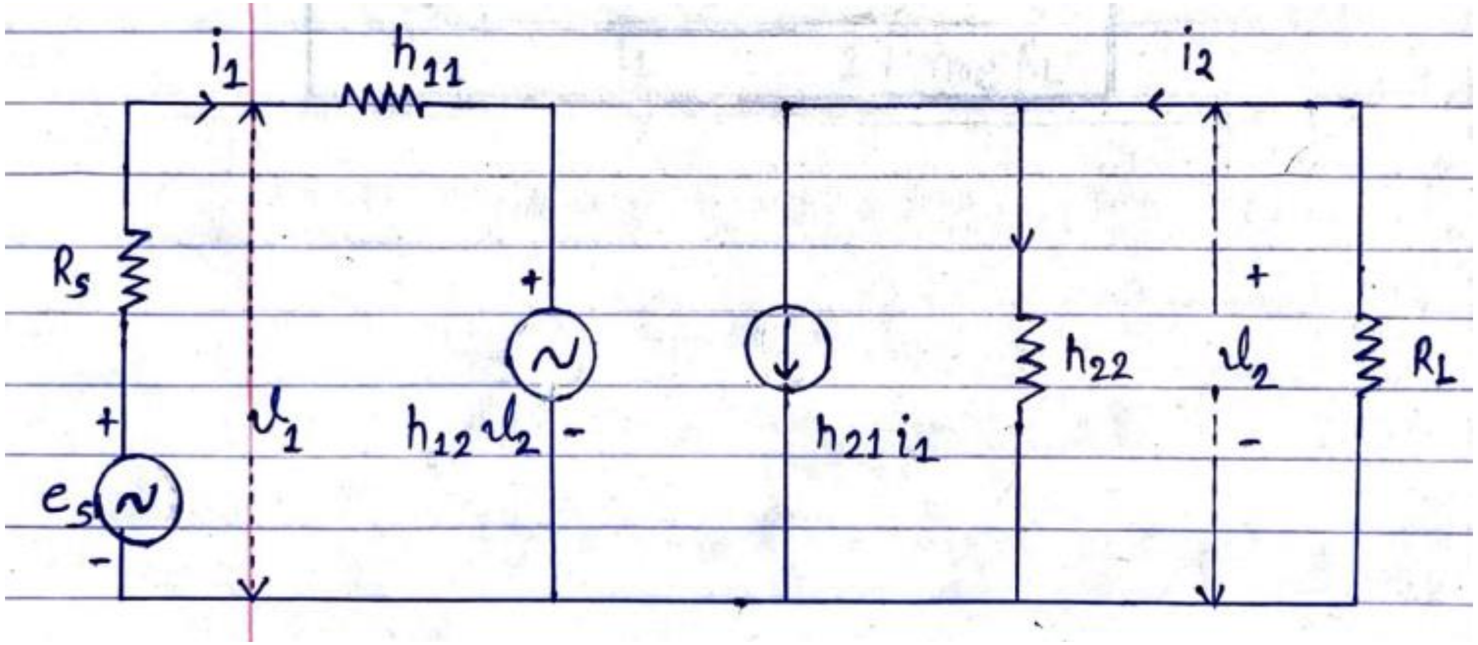


(1)



(2) & (3) = HW

- CE હાઈબ્રીડ મોડેલનો સરળ h-પ્રાચલ પરિપથ -



$$v_1 = h_{ie}\, i_1 + h_{re} v_2 \quad \text{———} \quad (1)$$

$$i_2 = h_{fe} i_1 + h_{oe} v_2 \quad \text{———} \quad (2)$$

(1) Current Gain,

$$\boldsymbol{A_{ie}} = -\frac{i_2}{i_1} \quad \text{———} \quad (3)$$

ઋણ નિશાની બને પ્રવાહ એકબીજાથી વિરુદ્ધ દિશામાં હોવાનું સૂચવે છે.

$$i_2 = h_{fe} i_1 + h_{oe} v_2 \text{ (eqn 2)}$$

$$i_2 = h_{fe} i_1 + h_{oe}\,(-i_2 R_L)$$

$$i_2\,(1 + h_{oe} R_L) = h_{fe} i_1$$

$$\boxed{\boldsymbol{A_{ie}} = -\frac{i_2}{i_1} = -\frac{h_{fe}}{(1 + h_{oe} R_L)}}$$

(2) Input Resistance,

$$R_{ie} = \frac{v_1}{i_1} \quad \text{——} \quad (4)$$

$$v_1 = h_{ie}\, i_1 + h_{re} v_2$$

$$v_1 = h_{ie}\, i_1 + h_{re}(-i_2 R_L)$$

$$v_1 = h_{ie}\, i_1 + h_{re}(+i_1\, A_{ie} R_L)(eqn\ 3)$$

$$v_1 = h_{ie}\, i_1 + h_{re}\left(i_1 \frac{h_{fe}}{(\frac{1}{R_L} + h_{oe})R_L} R_L\right)(eqn\ 3)$$

$$\boxed{\frac{v_1}{i_1} = h_{ie} + h_{re}\left(\frac{h_{fe}}{(\frac{1}{R_L} + h_{oe})}\right)}$$

(3) Voltage Gain,

$$A_{ve} = \frac{v_2}{v_1} \quad \text{——} \quad (5)$$

$$v_1 = h_{ie}\, i_1 + h_{re} v_2$$

$$\boxed{\textit{Current Gain},\ A_{ie} = -\frac{i_2}{i_1} = -\frac{h_{fe}}{(1 + h_{oe} R_L)}}$$

$$i_1 = \frac{i_2(1 + h_{oe} R_L)}{h_{fe}}$$

$$\boxed{i_2 = -\frac{v_2}{R_L}}$$

$$i_1 = \frac{-\frac{v_2}{R_L}(1 + h_{oe} R_L)}{h_{fe}}$$

$$\boldsymbol{A_{ve}} = -\frac{h_{fe}R_L}{h_{ie} + R_L(h_{ie}h_{oe} - h_{re}h_{fe})}$$

(4) Power Gain, $\boldsymbol{A_{pe}} = \boldsymbol{A_{ve}}\ \boldsymbol{A_{ie}}$

(5) Output Resistance, $\boldsymbol{R_{ie}} = \left(h_{oe} - \frac{h_{fe}h_{re}}{h_{ie} + \boldsymbol{R_s}}\right)^{-1}$

Property	CE	CB	CC
Current Gain	Large 20-200 (β)	Appox. 0.85 To 0.995 (α)	High 20-200 (β+1)
Voltage Gain	Very High	High	<1
Power Gain	Highest	Moderate	Less Than others
Input Impedance	1 KΩ To 2KΩ	Very Low 20Ω-50Ω	Very High 150KΩ To 600KΩ
Output Impedance	Around 50 KΩ	Very High 1MΩ-2 MΩ	Very Low 100Ω-1000Ω
Phase Difference	180°	0°	0°