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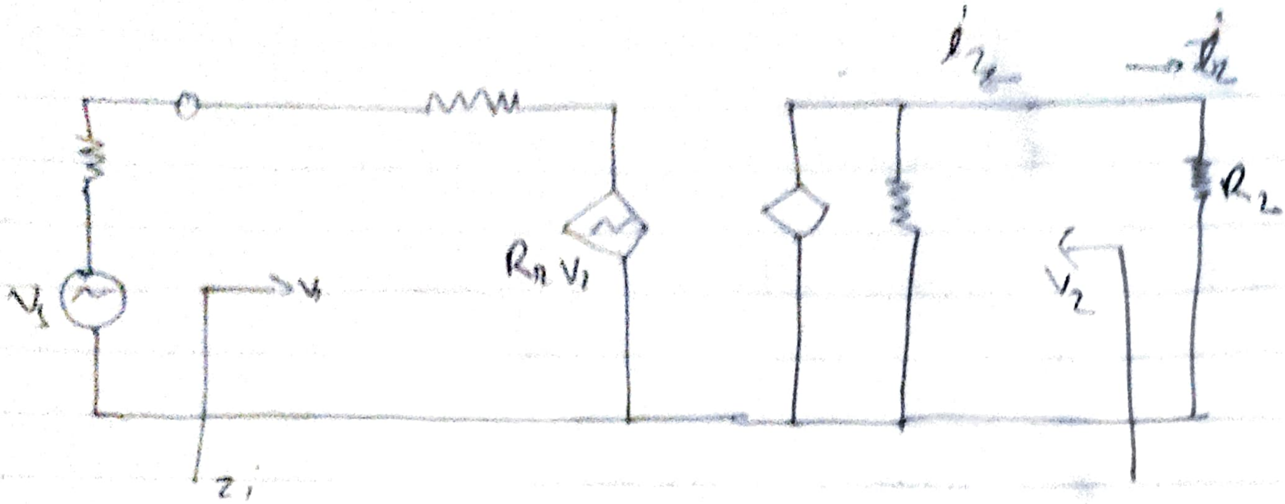
1.



Ans:- Current gain $(A_i) = \frac{i_L}{i_2} = -\frac{i_2}{i_1}$

Voltage drop across R_2 $V_2 = i_L R_L = -i_2 R_L$.

~~from~~ Applying KVL

$i_2 = h_f i_2 + h_o(-i_2 R_L)$

Add $h_o i_2 R_L$ on both sides

$i_2 + h_o i_2 R_L = R_f i_1$

$i_2(1 + h_o R_L) = h_f i_2$

$i_2 = \frac{h_f i_2}{1 + h_o R_2}$;

multiply by $-1/i_1$

$-\frac{i_2}{i_2} = \boxed{A_i = \frac{-h_f}{1 + h_o R_L}}$

Voltage gain (A_v) = $\frac{\text{o/p voltage}}{\text{i/p voltage}}$

$$= \frac{V_2}{V_i} = \frac{-I_2 R_L}{V_i}$$

$$A_i = -i_2/i_1 \; ; \quad -i_2 = i_1 A_i$$

$$\therefore \quad A_v = \frac{i_1 A_i R_L}{V_i}$$

$$= \frac{A_i R_L}{Z_i}$$

$$Z_i = h_i - \frac{h_r h_f}{1/R_L + h_o}$$

$$A_i = -\frac{h_f}{1 + h_o R_L}$$

$$A_v = -\frac{h_f R_L}{h_i + (h_i h_o - h_r h_f) R_L}$$

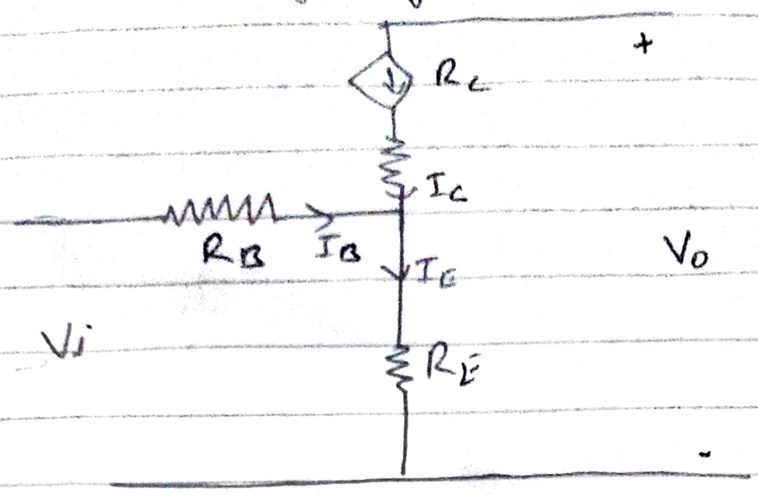
$$\boxed{A_v = \frac{-h_f R_L}{h_i + \Delta h R_L}}$$

ii) Power gain $A_p = A_v \times A_i$

$$= \left(\frac{-h_f R_L}{h_i + \Delta h R_L}\right) \times -\left(\frac{h_f}{1 + h_o R_L}\right)$$

$$A_p = \frac{h_f^2 R_L}{(h_i + \Delta h R_L)(1 + h_o R_L)}$$

2) Find the Voltage gain



Applying KVL in & input & output loop.

$$V_i = I_B R_B + I_E R_E \quad —(1)$$
$$V_o = I_C R_C + I_E R_E \quad —(2)$$

$$R_E = \frac{26mV}{I_E} \Rightarrow I_E R_E = 26mV \quad —(3)$$

$$\text{Voltage gain} = \frac{V_o}{V_i}$$

From eq (1) & (2)

$$\text{Voltage gain} = \frac{I_C R_C + I_E R_E}{I_B R_B + I_E R_E}$$

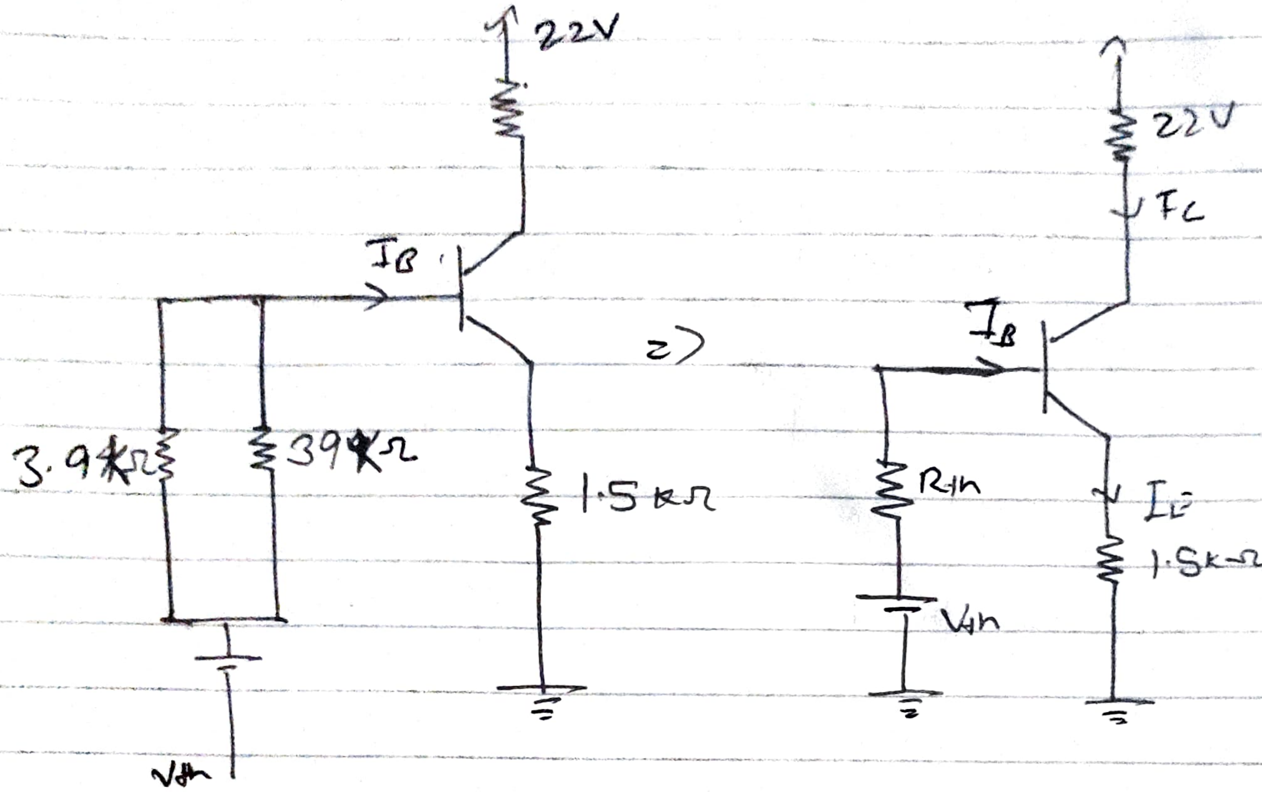
$$\text{From eq}^n \text{ III} = \frac{I_C R_C + 26mV}{I_B R_B + 26mV} \approx \frac{I_C R_C}{I_B R_B}$$

$$I_C = (\beta + 1) I_B$$

$$\text{Voltage Gain} = (\beta + 1) \times \frac{R_C}{R_B} \Rightarrow 101 \times \frac{3}{100}$$

$$= 3.03$$

3) Equivalent circuit will be like.



$$R_{th} = \left(\frac{3.9 \times 39}{3.9 + 39}\right) k\Omega$$

$$= 3.5454 \simeq 3.55$$

$$V_{th} = \frac{3.9 \times 22}{39 + 3.9} = 2.0205$$

Applying KVL.

$$V_{th} - R_{th} I_B - V_{BE} - I_E(1.5) = 0$$

$$2.02 - 3.55 \times I_B - 0.7 - (\beta+1) I_B \times 1.5 = 0$$

$$2.02 - 3.55 I_B - 0.7 - (141 \times 1.5) I_B = 0$$

$$I_B = \left(\frac{2.02 - 0.7}{3.55 + 141 \times 1.5}\right)$$

$$I_c = \beta I_B = 140 \times \frac{2.02 - 0.7}{3.55 + (141 \times 1.5)}$$

$$= 0.8593$$

$$= 0.86\ mA$$

$$V_c = I_c R_c$$

$$= 0.86 \times 10$$

$$= 8.6V$$