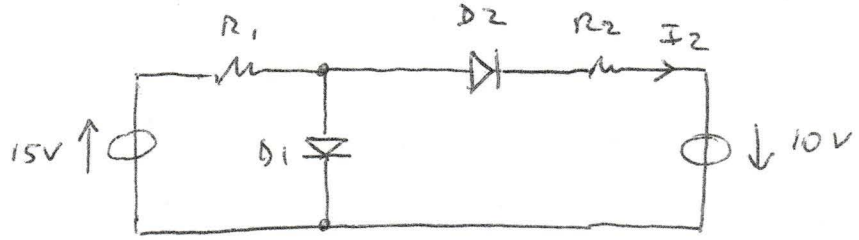
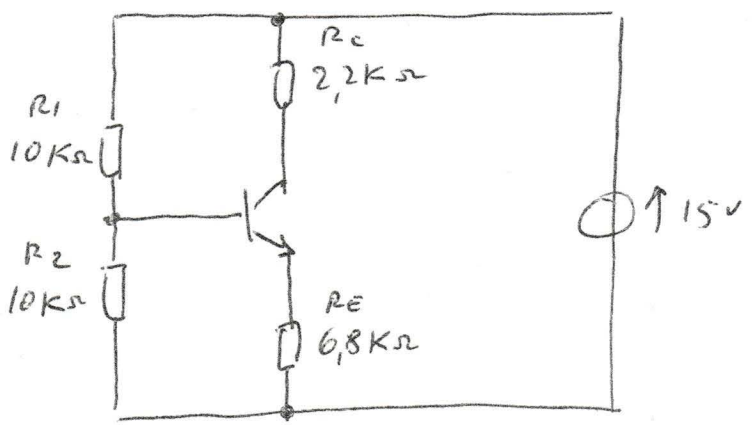
NOME

1) DETERMINARE LA CORRENTE I_2



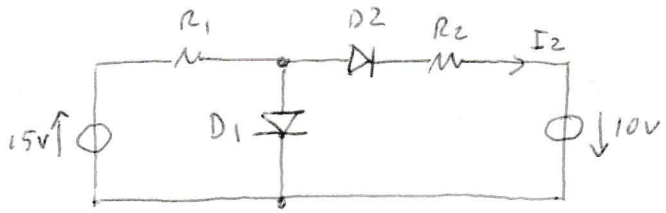
DIODI IDEALI
$R_1 = 1K\Omega$ / $10K\Omega$
$R_2 = 5K\Omega$

2) DETERMINARE CORRENTI E TENSIONI DI POLARIZZAZIONE
(ASSUMERE $V_{BE} = 0,7\,V$ $h_{FE} = 100$)



A

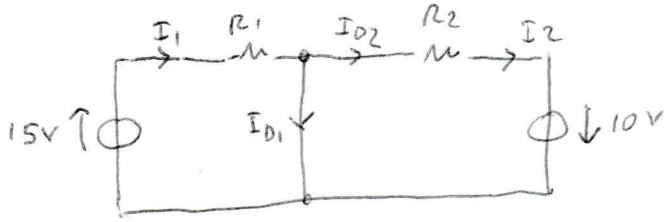
1)



DIODI IDEALI
$R_1 = 1\,K\Omega$ ←
$R_2 = 5\,K\Omega$
I_2 ?

* Hp1 D1 e D2 in conduzione (D1 ON, D2 ON)

CIRC. EQUIV



$I_2 = \frac{10V}{R_2} = \frac{10V}{5K\Omega} = 2\,mA$

$I_{D1} = I_1 - I_2 = \frac{15V}{R_1} - \frac{10V}{R_2} = \frac{15V}{1K\Omega} - \frac{10V}{5K\Omega} = 15mA - 2mA = 13mA$

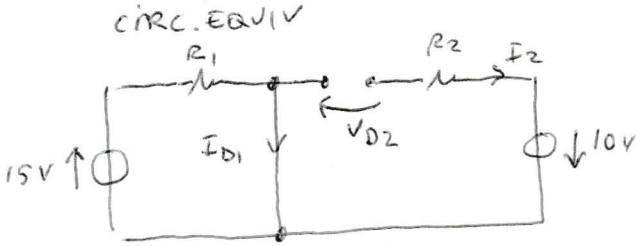
$I_{D2} = I_2 = 2\,mA$

- VERIFICA IPOTESI

D1 ON SE $I_{D1} > 0$ ($I_{D1} = 13\,mA$) VERIFICATO } IPOTESI VERIFICATA
D2 ON SE $I_{D2} > 0$ ($I_{D2} = 2\,mA$) VERIFICATO }

* Hp2 D1 ON, D2 OFF

CIRC. EQUIV



$I_2 = 0$

$I_{D1} = \frac{15V}{R_1} = \frac{15V}{1K\Omega} = 15mA$

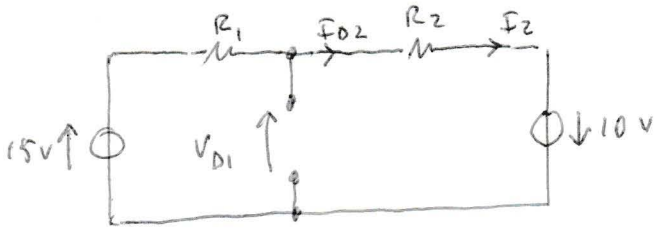
$V_{D2} = 10V$

- VERIFICA IPOTESI

D1 ON SE $I_{D1} > 0$ ($I_{D1} = 15mA$) VERIFICATO } IPOTESI NON VERIFICATA
D2 OFF SE $V_{D2} < 0$ ($V_{D2} = 10V$) NON VERIFICATO }

* Ip 3 D1 OFF, D2 ON

CIRC. EQUIV.



$I_2 = \frac{15+10}{R_1+R_2} = \frac{25V}{6K\Omega} = 1,67 mA$

$V_{D1} = 15V - R_1 I_2 = 15V - 1K\Omega \cdot 1,67mA = 15V - 1,67V = 13,33V$

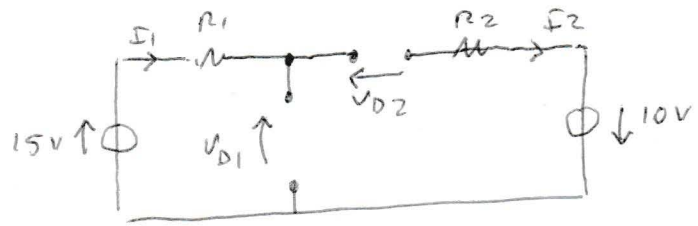
$I_{D2} = I_2 = 1,67 mA$

- VERIFICA IPOTESI

D1 OFF SE $V_{D1} < 0$ ($V_{D1} = 13,33V$) NON VERIFICATO
D2 ON SE $I_{D2} > 0$ ($I_{D2} = 1,67mA$) VERIFICATO
} IPOTESI NON VERIFICATA

* Ip 4 D1 OFF, D2 OFF

CIRC. EQUIV.



$I_1 = 0$

$I_2 = 0$

$V_{D1} = 15V - R_1 \cdot I_1 = 15V$

$V_{D2} = 10V + V_{D1} - R_2 I_2 = 10V + 15V = 25V$

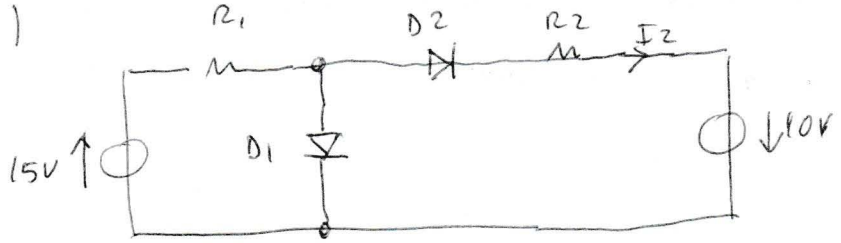
- VERIFICA IPOTESI

D1 OFF SE $V_{D1} < 0$ ($V_{D1} = 15V$) NON VERIFICATO
D2 OFF SE $V_{D2} < 0$ ($V_{D2} = 25V$) NON VERIFICATO
} IPOTESI NON VERIFICATA

PERTANTO, LO STATO DI FUNZIONAMENTO DELLA COPPIA DI DIODI È QUELLO CORRISPONDENTE ALL'IPOTESI N 1 (D1 ON & D2 ON) CON $I_2 = 2 mA$.

B

1)



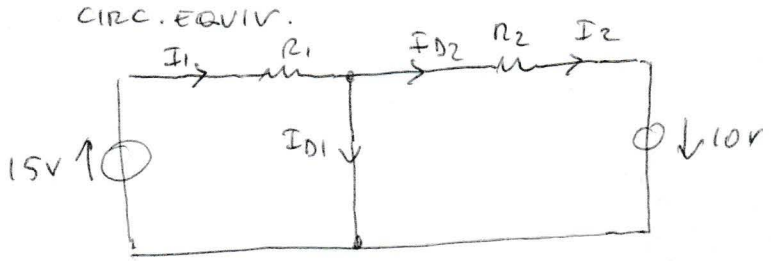
DIODI IDEALI

$R_1 = 10\,K\Omega$ ←

$R_2 = 5\,K\Omega$

* Ipt D1 e D2 in conduzione → (D1 ON, D2 ON)

CIRC. EQUIV.



$I_2 = I_{D2} = \frac{10\,V}{R_2} = \frac{10\,V}{5K\Omega} = 2\,mA$.

$I_1 = \frac{15\,V}{R_1} = \frac{15\,V}{10K\Omega} = 1{,}5\,mA$.

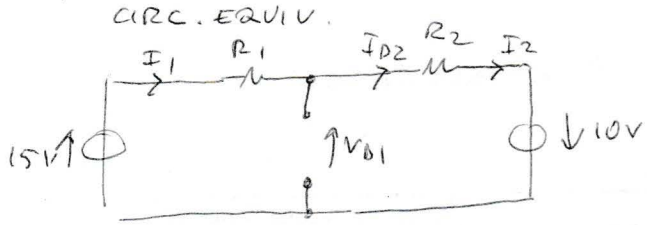
$I_{D1} = I_1 - I_2 = 1{,}5\,mA - 2\,mA = -0{,}5\,mA$.

- VERIFICA IPOTESI
  - D1 ON SE $I_{D1} > 0$ ($I_{D1} = -0{,}5\,mA$) NON VERIFICATO
  - D2 ON SE $I_{D2} > 0$ ($I_{D2} = 2\,mA$) VERIFICATO

} IPOTESI NON VERIFICATA.

* Ipt D1 OFF e D2 ON

CIRC. EQUIV.



$I_1 = I_2 = I_{D2} = \frac{10+15}{R_1+R_2} = \frac{25\,V}{15\,K\Omega} = 1{,}67\,mA$

$V_{D1} = 15V - R1 I_1 = -7{,}7\,V$

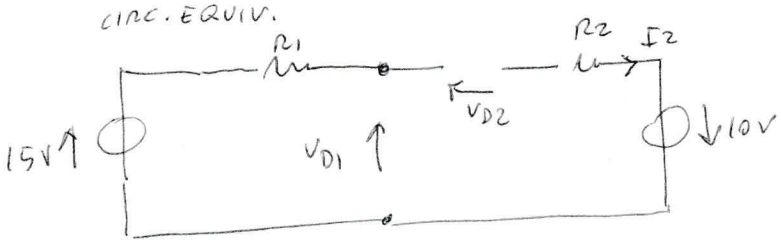
- VERIFICA IPOTESI
  - D2 ON se $I_{D2} > 0$ ($I_{D2} = 1{,}67\,mA$) VERIFICATA.
  - D1 OFF se $V_{D1} < 0$ ($V_{D1} = -1{,}7\,V$) VERIFICATA.

} IPOTESI VERIFICATA

PERTANTO il circuito funziona con D1 OFF e D2 ON
e risulta $I_2 = 1{,}67\,mA$.

* Hp3 D1 OFF, D2 OFF.

CIRC. EQUIV.



$I_2 = 0$

$V_{D2} = 25\,V$

$V_{D1} = 15\,V$

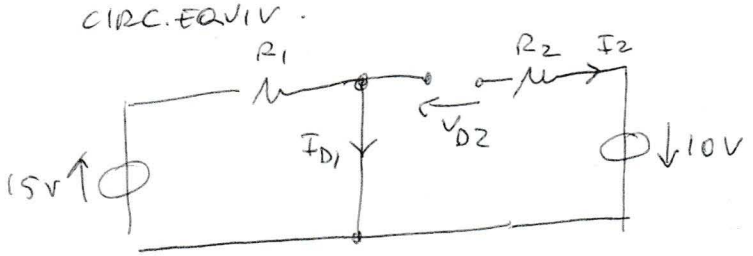
- VERIFICA IPOTESI

D2 OFF se $V_{D2} < 0$ ($V_{D2} = 25\,V$) NON VERIFICATA } HP. NON VERIFICATA

D1 OFF se $V_{D1} < 0$ ($V_{D1} = 15\,V$) NON VERIFICATA }

* Hp4 D1 ON, D2 OFF

CIRC. EQUIV.



$I_2 = 0$

$I_{D1} = \frac{15\,V}{R_1} = \frac{15}{10K} = 1{,}5\,mA$

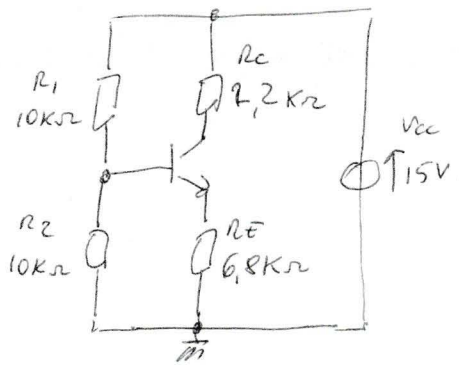
$V_{D2} = 10\,V$

- VERIFICO IPOTESI

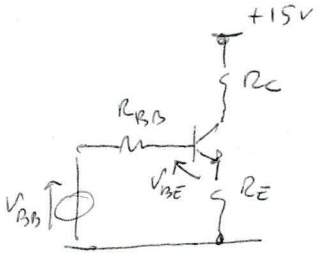
D1 ON SE $I_{D1} > 0$ ($I_{D1} = 1{,}5\,mA$) VERIFICATA } HP NON VERIFICATA

D2 OFF SE $V_{D2} < 0$ ($V_{D2} = 10\,V$) NON VERIFICATA }

2)



$\Rightarrow$



$$V_{BB} = \frac{V_{CC} \cdot R_2}{R_1 + R_2} = \frac{15 \cdot 10K}{20K} = 7{,}5\,V$$

$$R_{BB} = R_1 \| R_2 = 5\,k\Omega$$

LKT · maglia d'ingresso

$$V_{BB} = R_{BB} I_B + V_{BE} + R_E I_E \qquad I_E = I_C + I_B$$

Hp. funz. lineare $\begin{cases} V_{BE} = 0{,}7\,V \\ I_C = h_{FE} I_B \end{cases} \rightarrow I_E = (h_{FE}+1) I_B$

$$V_{BB} = V_{BE} + \left[R_{BB} + R_E (h_{FE}+1)\right] I_B \rightarrow$$

$$I_B = \frac{V_{BB} - V_{BE}}{R_{BB} + R_E (h_{FE}+1)} = 9{,}83\,\mu A$$

$$\rightarrow \begin{cases} I_C = h_{FE} I_B = 983\,\mu A \\ I_E = I_B + I_C = 993\,\mu A \end{cases}$$

LKT maglia di uscita

$$V_{CC} = R_C I_C + V_{CE} + R_E I_E \rightarrow$$

$$V_{CE} = V_{CC} - R_C I_C - R_E I_E$$

$$R_C I_C = 2{,}2K \cdot 983\,\mu A = 2{,}16\,V$$

$$R_E I_E = 6{,}8K \cdot 993\,\mu A = 6{,}75\,V$$

$$V_{CE} = 15 - 2{,}16 - 6{,}75 = 6{,}09\,V$$

$V_{CE} > 0$ Hp di funz. lineare confermata

$$\begin{cases} I_C = 983\,\mu A \\ V_{CE} = 6{,}09\,V \end{cases}$$