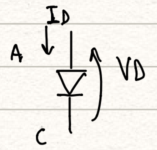
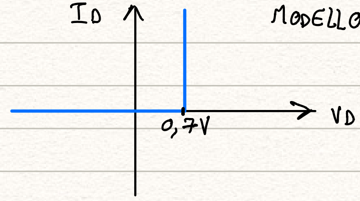
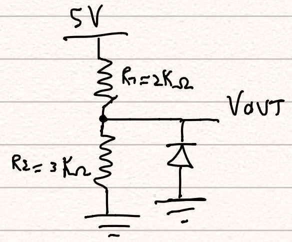


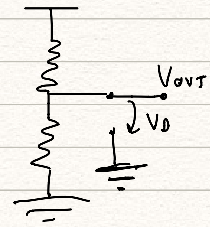




MODELLO CIRCUITALE

## esercizio 1:




IPOTIZZANDO IL DIODO SPENTO:

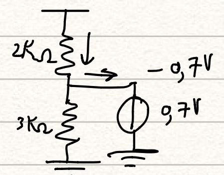


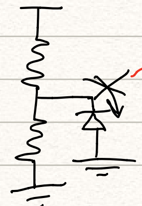

$$V_{OUT} = \frac{\cancel{5}^{1} V \cdot 3\cancel{K}\Omega}{\cancel{5}_{1}\cancel{K}\Omega} = 3V$$

$$V_D = 0 - 3V = -3V$$

IPOTESI 2:

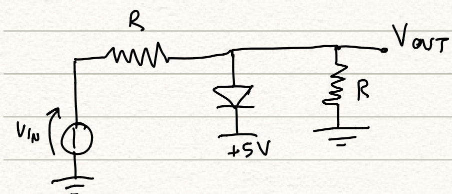
DIODO ACCESO



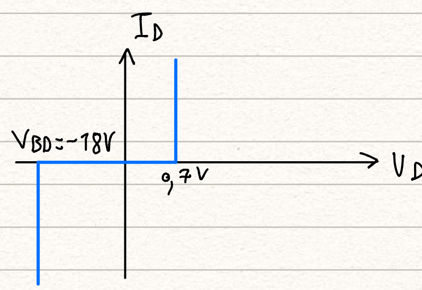
ipotesi sbagliata

## esercizio 2:




$R = 5K\Omega$

$V_{BD} = -18V$

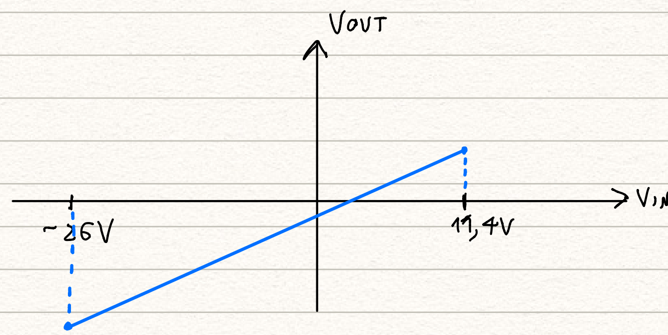


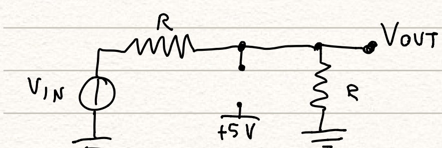

1) Caratteristica statica $V_{OUT} = f(V_{IN})$

HP diodo spento

Hp è verificata se

$$-18V < V_D < 0,7V$$




$V_D = V_{OUT} - 5V$ con diodo spento

$$V_{OUT} = V_{IN} \cdot \frac{R}{2R} = \frac{V_{IN}}{2}$$

$$-18V < V_D < 0,7V$$

$$-18V < V_{OUT} - 5V < 0,7V$$

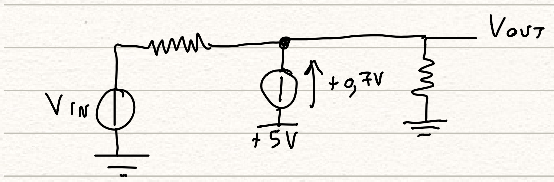
$$-18V < \frac{V_{IN}}{2} - 5V < 0,7V$$

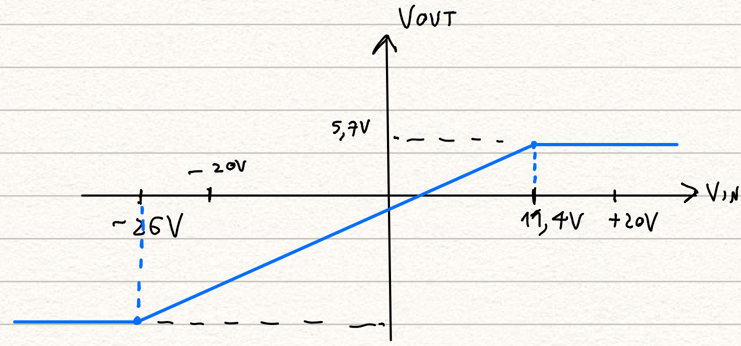
DIODO SPENTO

$V_{IN} < 11,4V$

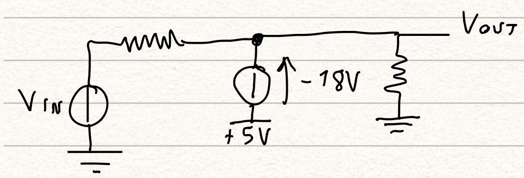
$V_{IN} > -26V$

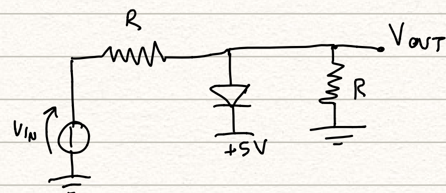
per $V_{IN} > 11,4$ V il diodo è acceso in DIRETTA




per $V_{IN} < -26$ V

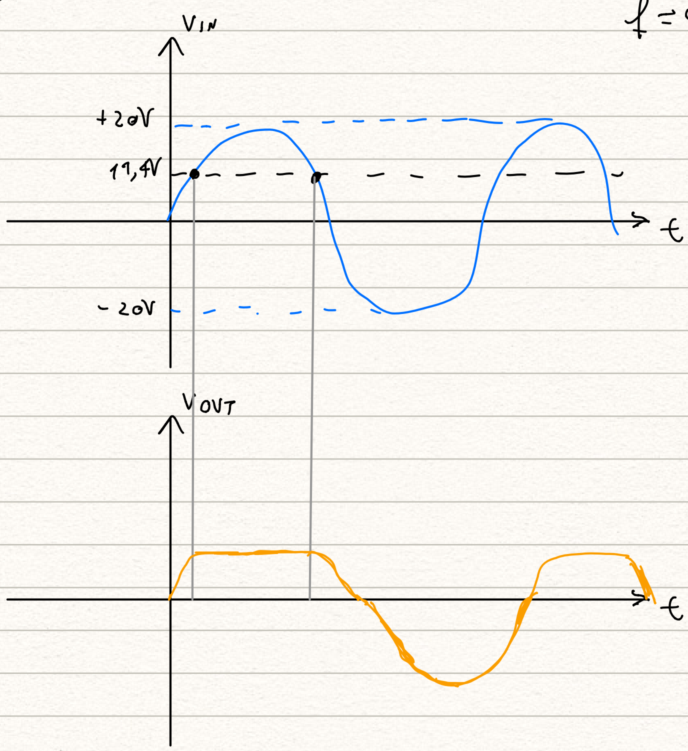



2) Sia $V_{IN} = V_0 \sin(2\pi f t)$

$V_0 = 20V$

$f = 50Hz$




per $V_{IN}(t) < 11,4V$ $\quad V_{OUT} = \dfrac{V_{IN}(t)}{2}$

Per $V_{IN}(t) > 11,4V$

$V_{OUT} = +5,7V$

$t_1$ tale che $V_{IN}(t_1) = 11,4V$

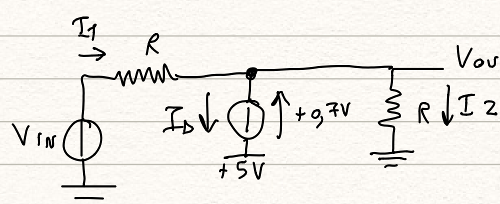
$20V \sin(2\pi f t_1) = 11,4V$

$t_1 = 1,93$ ms

3) $P_{MAX}$ dissipata dal diodo con $V_{IN} = 20V \sin(2\pi f t)$

$P_D = V_D \cdot I_D$

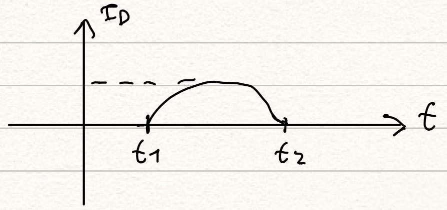
$I_D = I_1 - I_2$




$I_1 = \dfrac{V_{IN}(t) - V_{OUT}(t)}{R} = \dfrac{V_{IN}}{R} - \dfrac{5,7V}{R}$

$I_2 = \dfrac{V_{OUT}(t)}{R} = \dfrac{5,7V}{R}$

$I_D = \dfrac{V_{IN}}{R} - \dfrac{5,7V}{R} - \dfrac{5,7V}{R}$

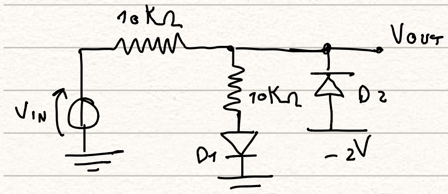


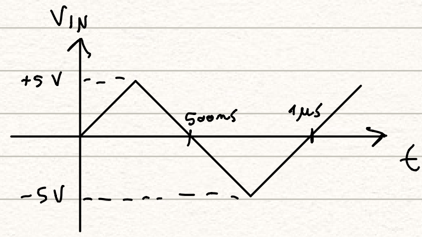

$I_{D\,MAX}$ si ha per $V_{IN}(t)_{MAX}$

$$I_{D\,MAX} = \frac{20 - 11{,}4V}{R} = \frac{8{,}6\,V}{R} = 1{,}72\,mA$$

$$P_{D\,MAX} = 0{,}7V \cdot 1{,}72\,mA = 1{,}204\,W$$

esercizio 3:



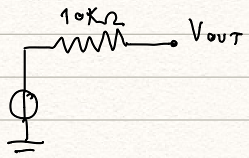



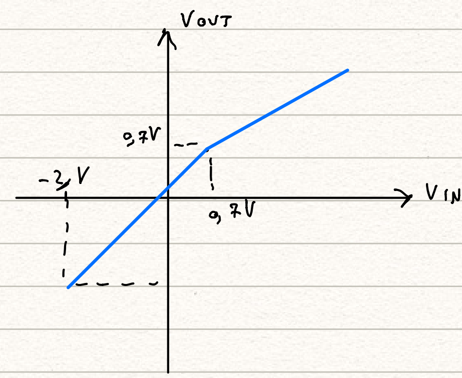

1) Tracciare su un grafico $V_{OUT}(t)$

$D_2$ è spento per $V_{OUT} > -2{,}7V$
$D_1$ è spento per $V_{OUT} < 0{,}7V$

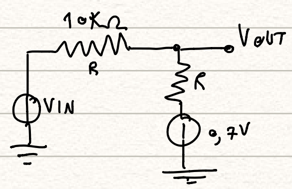
| | -2,7V | | 0,7V |
|---|---|---|---|
| $D_1$ off<br>$D_2$ ON | | $D_1$ off<br>$D_2$ off | $D_1$ ON<br>$D_2$ off |

se entrambi i diodi sono spenti

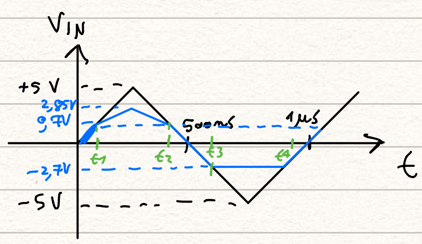


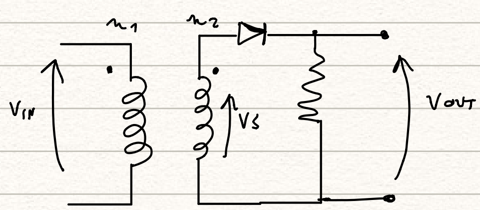

se solo $D_1$ è acceso:




$$V_{OUT} = \frac{R}{2R}\left(V_{IN} - 0{,}7V\right) + 0{,}7V$$




esercizio 4:



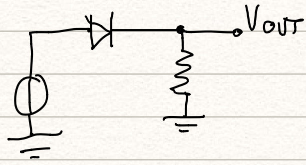

$V_{IN} = 220\sqrt{2}\,V \sin(2\pi f t)$ con $f = 50\,hz$

$R = 1\,K\Omega$

1) Dimensionare $\frac{n_1}{n_2}$ per avere $V_{S\,MAX} = 12V$

$\frac{V_{IN}}{n_1} = \frac{V_S}{n_2}$ $\qquad V_S = V_{IN} \cdot \frac{n_2}{n_1}$ $\qquad V_{S\,MAX} = V_{IN\,MAX} \cdot \frac{n_2}{n_1} = 12V \longrightarrow \frac{n_1}{n_2} = 26$

circuito equivalente per analizzare



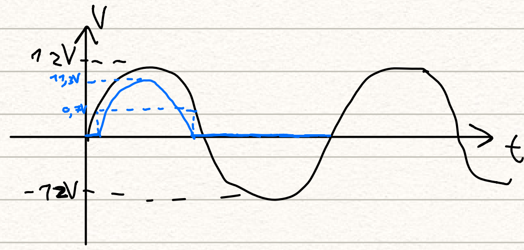

$V_S = 12V \sin(2\pi f t) \qquad f = 50Hz$

Il diodo si accende per $V_S(t) \geq 0{,}7V$

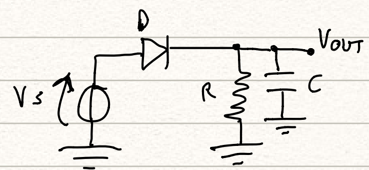
DIODO ACCESO $\longrightarrow V_{OUT} = V_S - 0{,}7V$

DIODO SPENTO $\longrightarrow V_{OUT} = 0\ V$

2)

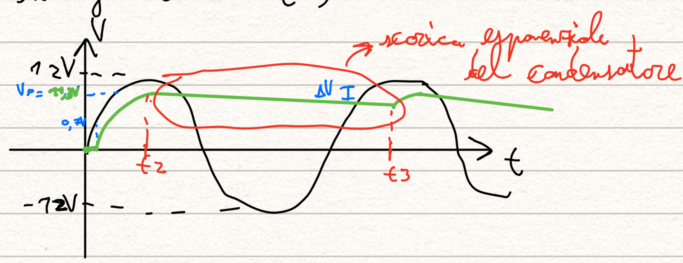



3) Aggiungere C parallelo ad R tale che $RC >> T \qquad (T = \frac{1}{f})$




$I_C = C \frac{dV_C}{dt}$

disegnare $V_{OUT}(t)$




per $V_S(t_2^+) = 12$ il diodo si spegne

$V_C(t_2) = 11{,}3V$

questo circuito è un RADDRIZZATORE A SINGOLA SEMIONDA

ripple $= \frac{\Delta V}{V_{Picco}}$

4) dimensionare C per avere un ripple $< 1\%$

con diodo spento

$V_{OUT} = V_P e^{-\frac{t}{RC}}$ $\qquad V_{OUT}(t_3) = ?$ $\qquad \Delta V_{MAX} = V_{OUT}(t_3) - V_P$

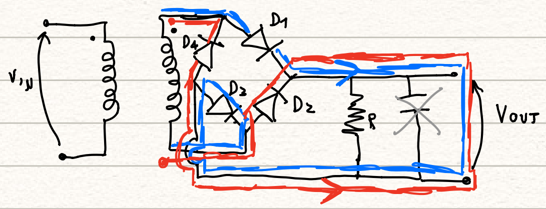
↳ approssimiamo $V_{OUT}(t_3)$ con $V_{OUT}(T)$ [conservativo!]

$$V_{OUT} = V_P e^{-\frac{t}{RC}} \simeq V_P\left(1 - \frac{t}{RC}\right)$$

$$\Delta V \simeq V_P - \left[V_P\left(1 - \frac{T}{RC}\right)\right] = V_P \cdot \frac{T}{RC} \qquad \frac{\Delta V}{V_P} < 1\% \qquad \frac{T}{RC} < 0,01$$

$$C > \frac{20\,ms}{1k\Omega \cdot 0,01} = 2\,mF$$

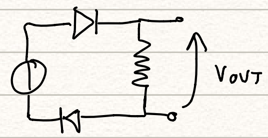
RADDRIZZATORE A DOPPIA SEMIONDA:

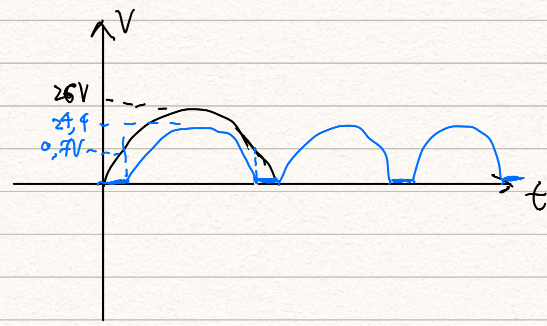



$R = 1k\Omega$ $\qquad V_S = 26\,V \sin(2\pi f t)$

1) Tracciare $V_{OUT}(t)$ senza considerare la capacità C

per $V_S$ positivo $\qquad$ $D_4$ spento, $D_2$ spento



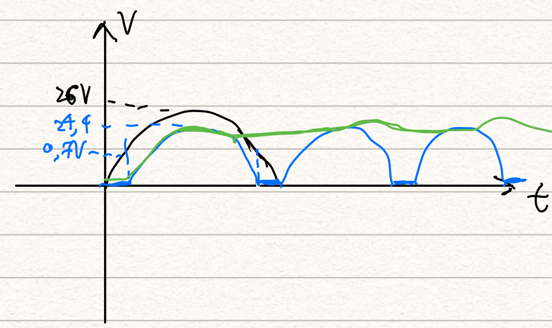




I diodi si accendono per $V_S > 1,4V$

con diodi accesi $V_{OUT} = V_S - 1,4V$

con diodi spenti $V_{OUT} = 0V$

tenendo conto del condensatore




per $V_S$ NEGATIVO

$D_1, D_3$ spenti