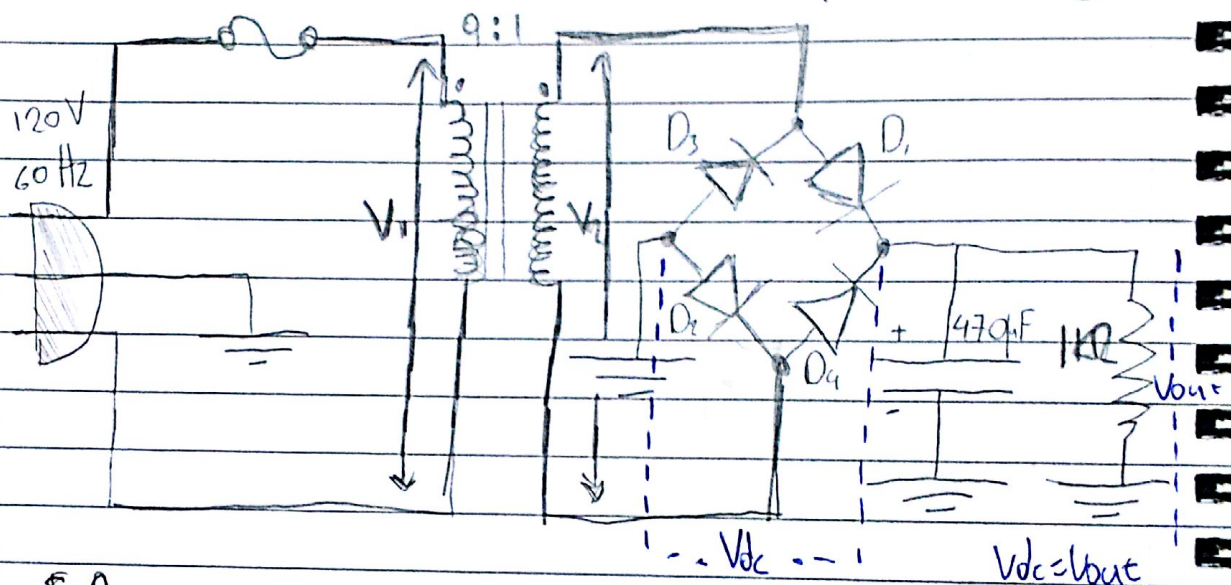


4

For the following bridge rectifier you are asked to find the dc output voltage (V_{out}) for the following errors:

- the capacitor is open circuit
- One of the diodes of the bridge is open circuit
- The electrolytic capacitor is connected with opposite polarity



Solution

$$V_1 = V_{rms} = 120V, \quad V_{p1} = \frac{V_{rms}}{0.707} = 169.7V$$

$$\frac{N_1}{N_2} = \frac{9}{1} = \frac{V_1}{V_2} = \frac{120}{V_2} \Rightarrow V_2 = \frac{120}{9}V, \quad V_2 = V_{rms} \approx 13.3V$$

$$V_{p2} = \frac{V_{rms}}{0.707} = \frac{13.3}{0.707} \approx 18.86V, \quad V_{p2} = V_{max} = 18.86V$$

- Due to the bridge rectifier, current flows even if V_2 changes polarity. So $T_{out} = 0.5T_{in} \Rightarrow f_{out} = 2f_{in} = 120Hz$

Due to the fact that $f_{out} = 2f_{in} \Rightarrow V_{dc} = \frac{2V_{p2}}{\pi} = 12V$
($V_{p2} = V_{out}$)

Because the capacitor and the resistor are in parallel they will have the same voltage, which is $V_{dc} = 12V$

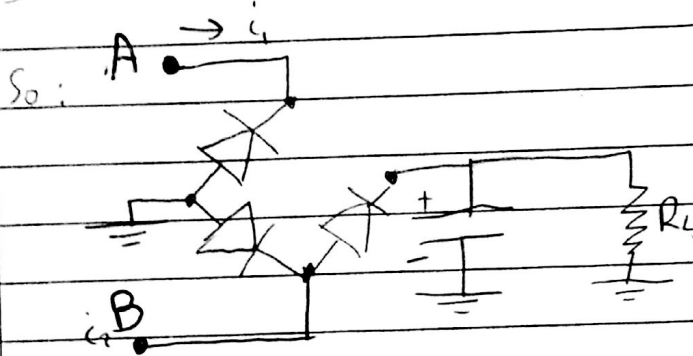
If the diodes aren't ideal then

$$V_{p(ant)} = V_{D_2} = 2 \cdot 0.7 = 1.4 \text{ V}$$

$$\text{So } V_{dc} = \frac{2 V_{p(ant)}}{\pi} = 11.11 \text{ V}$$

i) If the capacitor is open circuit, there will not be any change in the V_{dc} . It will have the same voltage: 12 V (ideally)
11.11 (not ideally)

ii) I will assume that D_1 is open. (It is the same for the rest diodes).



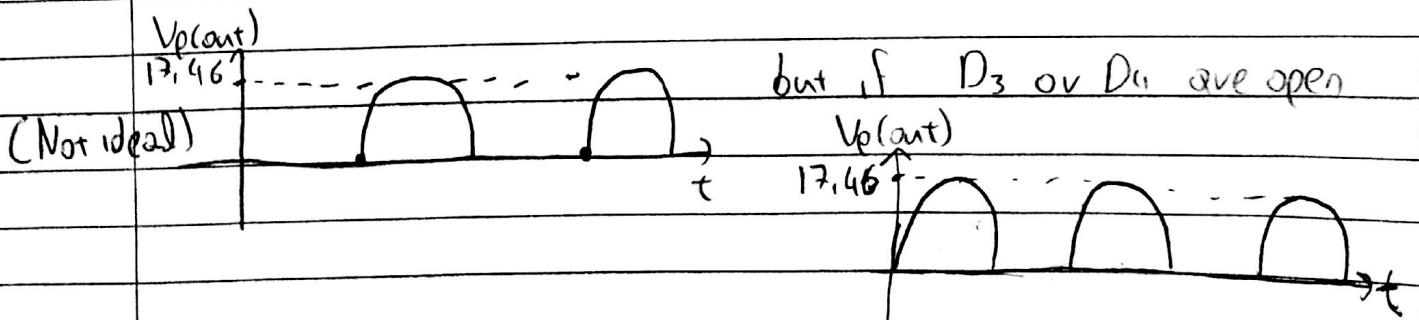
So if the current flows through A, we will have

$$V_{out} = V_{dc} = 0.$$

But if it flows through B we will have $V_{p(ant)}$.

Also $V_{p(ant)}$ will remain the same.

So: if D_1 or D_2 are open:



iii) If we reverse capacitor's polarity, it will explode destroying the circuit (just kidding).

I read somewhere that it may get damaged or behave like short circuit. So if it behaves like a short circuit $V_{dc} = 0$.

I don't understand though why it will explode or behave like short circuit. Is it because of the inner structure?