Q.3 A majority detector has three input variables **A**, **B** and **C** and two output light indicators. Green light (**G**) will be on if majority of the input variables are equal to 1. Red light (**R**) will be on if majority of the input variables are equal to 0.

(a) Construct a truth table for your design.

(10 Marks)

(b) Obtain logical expressions for **G** and **R**, respectively.

(10 Marks)

(c) Draw logic circuit implementations for **G** and **R**.

(5 Marks)

Solution:

(a) The truth table for the design is given as follows:

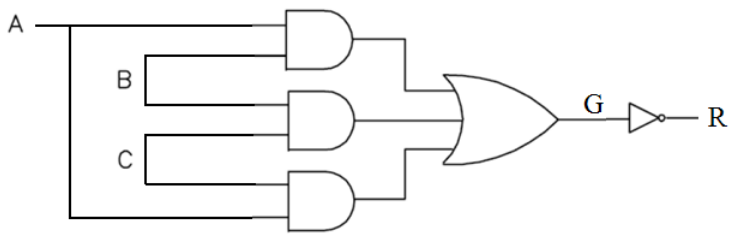
Input			Output	
A	B	C	G	R
0	0	0	0	1
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	0

(b) K map for G:

	$\mathbf{A \cdot B}$	$\mathbf{A \cdot \overline{B}}$	$\mathbf{\overline{A} \cdot \overline{B}}$	$\mathbf{\overline{A} \cdot B}$
C	1	1	0	1
$\mathbf{\overline{C}}$	1	0	0	0

We have $G = A \cdot B + A \cdot C + B \cdot C$ and $R = \overline{G}$.

(C) Logic Circuit Implementation



Q.4 The rectifier supply shown in Figure Q.4 below is used as part of an electronic device. The input is an AC voltage source with a frequency of 50Hz and a peak amplitude of 200V. The transformer primary to secondary ratio = 2:1. The load resistance is 100Ω.

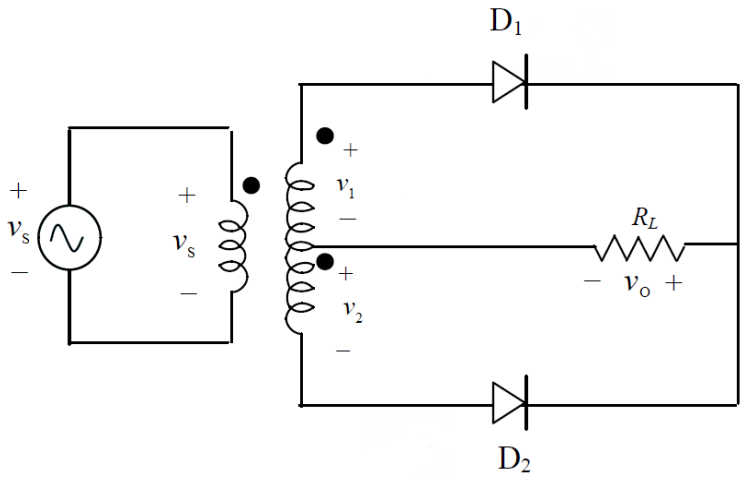


Figure Q.4

(a) Determine the output DC voltage. What is the peak-to-peak ripple in the output voltage? What is the percentage ripple?

(10 Marks)

(b) Sketch waveforms for v_s and v_o, respectively.

(10 Marks)

(c) Suggest an additional component to be added to the above circuit, which can yield a smoother the output voltage. Draw the revised circuit.

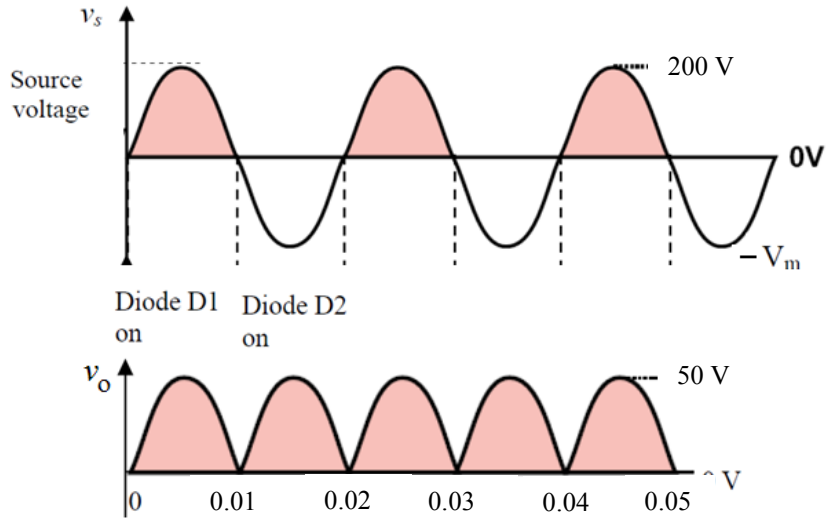
(5 Marks)

Solution:

(a) Peak value of the secondary voltage = 100 V. Peak value of v_1 and v_2 : $V_m = 50$ V

- DC output voltage (average load voltage): $V_{ave} = \frac{2V_m}{\pi} = \frac{100}{\pi} = 31.8$ V
- Peak-to-peak ripple voltage: $V_{p-p} = V_m - 0 = 50$ V
- The percentage ripple = $\left(V_{p-p}/V_{ave}\right) \times 100 = \frac{50}{31.8} \times 100 = 157\ \%$

(b) The waves for v_s and v_o



(c) Adding a capacitor as shown in the figure below will do the job.