

Practical Submission Sheet

Term: 2020-1	Submission Date: August 28th, 2020.
Lecture Date: August 28th, 2020.	Practical Number: 4
Course Code: PHY249	Section: G2903
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Concepts Learnt

Learnt different types of logic gates, how a single *universal* can be used to create other gates, how deMorgan's theorem helps us understand logic using boolean algebra.

Key Observations & Insights

The use of the NAND gate to replicate the behavior of other gates, namely AND and OR was tested. The effect of a zener diode in a circuit for current stabilization was tested. Physically, logic gates in essence are nothing but transistor circuits.

Application Areas

The existence of a *universal* gate means that if we have a discrete or integrated device with only type of gate, any other desired logical can be obtained. Zener diodes are useful in situations when a constant voltage supply is to be maintained.

Report

NAND and NOR gates are known to be *universal* gates —any other type of logic gate can be constructed by combining units of NAND or NOR alone. Here, we simulate the such a construction for the case of AND and OR gates.

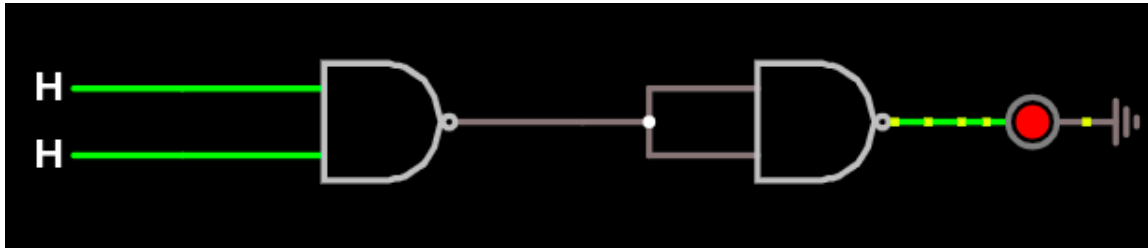


Figure 1: Circuit equivalent to an AND gate using just NAND gates.

For making an AND gate, we need a method to invert the output of a NAND gate. If we take another NAND gate and short circuit its input terminals, it behaves at a NOT gate/inverter. The reason being, it now takes only one input for both the terminals combined (both inputs would be either 0 or 1). When 0 is input to this, the NAND output would be 1 and in the case when 1 is input, this gate gives 0.

An AND gate is thus constructed as shown in figure 1.

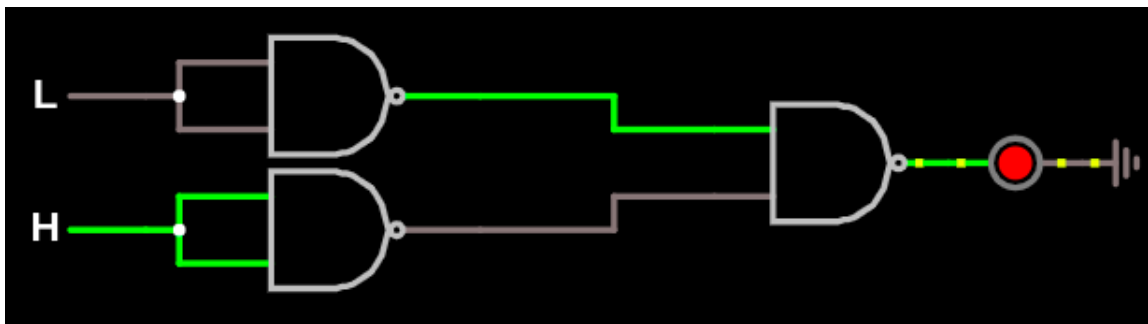


Figure 2: An equivalent OR gate created using NAND gates.

An analogous combination of NAND gates to construct an OR gate was also used, as shown in Figure 2.

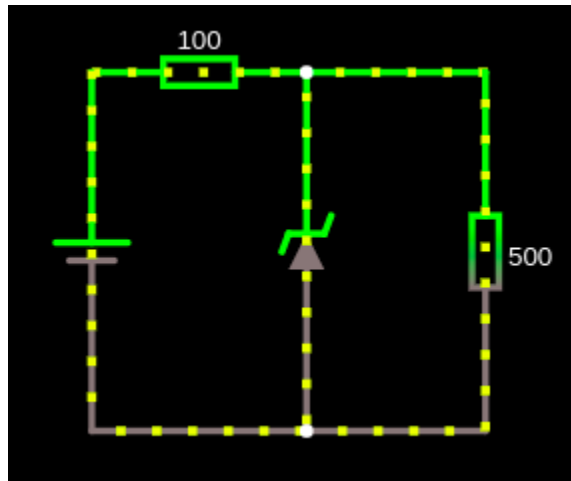


Figure 3: Zener circuit

A zener diode behaves as an emf source. When a load resistance is applied across two voltage supplies in parallel, the V_0 across it is controlled solely by the source right next to it. Therefore, a zener diode can be effectively used a voltage stabilizer.