

# Circuits Exam 1 Study Guide (fall 2020)

This exam covers and stresses the basics—the building block ‘vocabulary’ or Circuits, so to speak. This is the circuits equivalent of “knowing words so that you can build sentences”. As such, this is not primarily a memory test, but you should know by heart the following. In summary, if you feel good about the problems we have worked in class, and the design work you’ve done in the first 3 labs, you are in a great position to do extremely well on this exam!

## BASIC CIRCUIT LAWS

1. What is KVL and how does it apply in practice?
2. Ditto KCL.
3. What does  $\tilde{V} = \tilde{I}\tilde{Z}$  mean? How do you apply it in practice?

## CORE CONCEPTS

1. What is the impedance of a resistor  $\tilde{Z}_R$ ? For a capacitor  $\tilde{Z}_C$ ?
2. What is series equivalent resistance (or impedance) and how do you compute it?
3. Ditto parallel equivalent impedance
4. How do you compute power for a circuit element? Could you do it for a light bulb? For any resistor?
5. Battery life: know how to use the charge capacity to approximate its lifetime given the current it must supply.

## COMPLEX NUMBERS/PHASOR MATH

1. Know the equivalence between  $z = a + jb = re^{j\theta}$
2. Know how and why drawing a complex number is the equivalent of drawing a triangle and doing basic trig with  $\sin()$  and  $\cos()$

## BASIC DESIGN BUILDING BLOCKS—USEFUL CIRCUITS

1. Voltage Divider: Can you draw one? Can you solve the voltage input-output relationship? How and why are these useful in real life? Can you design one for a certain application (a la Lab 1)?

2. Wheatstone Bridge: Can you recognize one when you see it? What is the balance condition and why is it important for proper operation? What is the real-world application of the WB, its main purpose in Circuits life?
3. RC filters: Can you draw a LPF? HPF? BPF? Cutoff frequency: what does it represent, can you compute it and why is that single number so crucial in design? Would you recognize the transfer function  $\tilde{H}(\omega)$  for a LPF or HPF if you saw it?