**Elec Eng 2EI5**
**Design Project #1**

### *Problem Statement*

Design and build a dc power supply that delivers 10 mA at 3V ± 0.1V from a source that is 120V (rms) at 1 kHz.

### *Test Requirements*

1. In the lab, you will not work with a 120V source. You will use the function generator to produce a sinusoid of the amplitude that your design calls for at the output of a transformer.
2. In your report, you must explain your choice of input level (transformer output), how you would obtain that from a transformer (i.e. what the transformer specifications need to be) and then demonstrate that your circuit delivers a final output of 10 mA at 3V ± 0.1V.

### *Warning*

Power applications such as this project can be hazardous if care is not taken to avoid exceeding safe maximum currents and voltages. In this case we have eliminated one hazard since we will not work with high voltage. However, the use of reactive components (capacitors/inductors) can result in current/voltage spikes.

1. Carefully simulate your circuit before you attempt to build it.
2. Make sure that you are aware of the **current, voltage, and power ratings** for various components and do not exceed them.
3. Make sure that if you use a **polarized capacitor** that you connect it with the **correct polarity**.

### *Report Requirements*

Your submitted report should not exceed four pages. You are allowed:

1. A maximum of 2 pages showing your hand analysis and discussing design considerations;
2. A maximum of 1 page showing figures (circuit diagram, simulation results, etc.); and
3. A maximum of 1 page describing your simulations, reporting measured results, and comparing theory with experiment.

At a minimum, your report must include:

1. A picture of your physical circuit (including a label showing your name and the date);
2. A schematic of your circuit;
3. Screen captures of your measurements; and
4. Simulation conditions and results.

Your report will be assessed on the following:

1. Hand design (15 pts)
    a. Why did you choose a specific circuit topology? (So you need to show that you are aware of different topologies that can be used to achieve the required result, then explain why you chose the one that you did.)
    b. How did you calculate the component values needed for your circuit?

    c. What design tradeoffs, design margins, component ratings, safety, and other issues did you take into account in your design? ***(This point is very important – you must show that you considered safety issues and component ratings in your design and you must show that you have an understanding of design margins and tradeoffs.)***
2. Simulations (15 pts)
    a. What simulations did you choose to perform? (Specify what type of analysis you called for in your Spice deck and what settings you used for that analysis.)
    b. What Spice models did you have to use and how did you obtain parameters for those models?
3. Measurement (10 pts)
    a. What measurements did you perform on your circuit? (This includes specifying the settings that you used to supply inputs, the specific measurements you made at the output, and any measurements you made for troubleshooting.)
    b. Did the circuit meet specifications? Justify your answer using the specific measurements you took. (For example, if you say that you have an output of 3V ± 0.1V, which of your measurements shows the 3V value, and which of your measurements shows the 0.1V value?)
4. Discussion (5 pts)
    a. Explain any discrepancies between your hand calculations, Spice simulations, and measurements.
5. Presentation (5 pts)
    a. The 4 page limit.
    b. Professional quality of the report.
    c. Clear communication of content.

### *Workload & Time Management*

In order to successfully complete this project you will need to learn about:

1. Converting ac to dc;
2. The meaning of average voltage and voltage ripple;
3. Methods of reducing voltage ripple;
4. Using the Digilent Analog Discovery module;
5. Using a simulator;
6. Modeling diodes; and
7. Measuring ac signals.

Some of these items you will be able to learn from doing the first lab. However, doing what needs to be done for the project is your responsibility. You will need to plan. Figure out how much you want to do and the order in which you will need to do it.

Finally, re-read the Warning section above. DO NOT ATTEMPT TO BUILD THE FULL CIRCUIT BEFORE SIMULATING IT. You really need to have a good feel for how much current is going to run through your different components and ensure that it is within the safe limits for your components.