ECE-311 (ECE, NDSU)
Lab 2 – Experiment
Filter circuit synthesis

1. Objective

The objective of this lab is to engage students in lab activities that foster more independent thinking and pro-active learning. In contrast with previous labs (especially in Circuit Analysis I, where you were given step-by-step instructions on how to conduct experiments), here you must design or "synthesize" filter circuits and then analyze them via experimental measurements and simulations.

2. Description

You are given (select randomly from among the components available in the lab) three resistors and two capacitors. Values of their resistances and capacitances are not important; they can be of any values.

1) In the first part of this lab, you must provide a discussion of how many different types of filters one can build using the five given circuit elements. Your goal should be "as many as possible". You lab report should include this discussion and circuit diagram examples for each type of filter you mention. Also, in your report include a list with the values of all five components you picked-up.
2) In the second part, you must work with a low-pass filter and then with a high-pass filter. You must build each of them such that you achieve the lowest cutoff frequency and the highest cutoff frequency for the low-pass filter and the high-pass filter, respectively. Cutoff frequencies must be computed for the actual values of the components you picked-up. Create the two filters utilizing only some or all the five components, and propose and conduct measurements to collect data that you can use to plot the frequency response. Your report should include circuit diagrams, tables with collected data, and corresponding plots.
3) Thirdly, you will also create the two filters in LTSpice and simulate to analyze their frequency response. In your Spice simulations, you should use the same resistance and capacitance values as in your practical circuits. You must compare your simulations to your plots from part 2. Your report should include printouts of circuit diagrams and useful plots.
4) Finally, your report should include a discussion of what problems (if any) you faced in this lab and how you addressed them. Specify if you would like more labs like this or you would prefer more "step-by-step labs" like in the past.

You may find helpful to revisit selected labs from Circuit Analysis I; they can be found online. Also, you may find helpful to read-ahead Section 16.7 from textbook. In addition, the Internet is in most cases a very valuable source of information on many topics including that of filters.