

## A Fifth Order Elliptic High-Pass Filter

The object of this design project is to design, assemble, and evaluate a 5<sup>th</sup> order Elliptic high-pass filter. The specifications are:

$f_S/f_C$ ratio	$\geq 1.5$
$A_{\min}$	40 dB or greater
$f_C$	See equation below
High-frequency gain	1 (0 dB)

The cutoff frequency is to be given by

$$f_C = 1 \text{ kHz} + \frac{D - 1}{30} \times 4 \text{ kHz}$$

where  $D$  is the day of the month of your (or your lab partner's) birthday.

The first step is to obtain the filter transfer function. Then use Mathcad or any other software to display the Bode plot of gain versus frequency. In addition to displaying the overall Bode plot, display the Bode plot of each individual stage in the filter separately. Verify that the overall Bode plot satisfies the specifications. The second step is to obtain a circuit that realizes the transfer function. The second-order stages in the circuit must be state-variable and/or Tow-Thomas type filters. After you design the circuit, use SPICE to display the gain versus frequency. Verify that it agrees with the Bode plot made with Mathcad. The final step is to realize the filter in the lab and have it verified by Dr. Brewer. When you realize the filter, you should test each of the two second-order sections individually before connecting them together.

Dr. Brewer will announce the time schedule and due dates in the lab.