Exercise FIR.1

Find the coefficients for a FIR band-pass filter, such that $f_{a1} = 1.5kHz$ and $f_{a2} = 2.5kHz$. The filter should have a sampling frequency of 8 kHz and a *M*-value of 22.

- Please calculate the filter coefficients using the c_m formula (you can still use MATLAB for the calculation).
- You can compare the above results with Matlab function fir1().
- Make a transfer function and drawing the Bode plot for the designed filter.
- Simulating the filter in Matlab by applying different input signals with frequencies of 1 kHz, 2 kHz, and 3.5 kHz. Does the response match the Bode plot? (Use lsim in MATLAB for the simulation).

Exercise FIR.2

Design an FIR highpass filter with cutoff frequency $f_a = 1kHz$. The transition region is $\Delta f \leq 0.5\ kHz$, and the maximum allowable stop-band attenuation is $H_s \leq -50dB$. The sampling frequency is 5 kHz.

- Which window function should be chosen?

- What should the order of the filter be? What happens if the order is increased?

- Make the final FIR filter with the selected window function.

- Draw a Bode plot for the filter and argue that the filter specifications are met.