MIDTERM

March 2025

Digital Signal Processing

We will design a high-pass filter with the following specifications

1. Using the window technique, design the above filter.

a) Which window do you choose? Explain.

b) What is the length of the resulting filter?

c) Does the resulting filter meet the above requirements? Explain.

1. Now we will design the above filter using the frequency sampling method. The length of the filter is M = 31.

a) Verify that there are two samples (T1 and T2) in the transition band.

b) Write the sampled amplitude response (Hr(k))

c) Given T1 = 0.2 and T2 = 0.8, design the above high-pass filter. Does the designed filter meet the requirements? Explain.

d) Choose the best values of T1 and T2 for the given specifications. In this case, does the designed filter meet the requirements? Explain.

1. Compare the design results from the window technique and those from the best case of the frequency sampling method.
2. Given an input use the filters designed from question 1 and 2 (the best case) to filter x(n). Plot and explain the results (*Hint:* look at the ouput of the filters).
3. We repeat the frequency sampling method to design the above high-pass filter but using M = 32. Comment on the results.