Digital Systems and Designs

Tutorial 5

Question 01

Design an ideal low-pass filter with a frequency response

$$H_d\left(e^{j\omega}\right)=\begin{cases}1, & -\frac{\pi}{2}\le\omega\le\frac{\pi}{2}\\ 0, & \frac{\pi}{2}\le|\omega|\le\pi\end{cases}$$

with the window fuction

$$W(n)=\begin{cases}1, & -5\le n\le 5\\ 0, & otherwise\end{cases}$$

Question 02

Design an ideal low-pass filter with a frequency response

$$H_d\left(e^{j\omega}\right)=\begin{cases}e^{j2\omega}, & -\frac{\pi}{4}\le\omega\le\frac{\pi}{4}\\ 0, & \frac{\pi}{4}\le|\omega|\le\pi\end{cases}$$

with the window fuction

$$W(n)=\begin{cases}1, & 0\le n\le 4\\ 0, & otherwise\end{cases}$$

Question 03

Find the Kaiser window parameters, β and N, to design a low-pass filter with a cutoff frequency $\omega_c=\pi/2$, a stopband ripple $\delta_s=0.002$, and a transition bandwidth no larger than 0.1π.

Question 04

Design a low-pass filter with a cutoff frequency $\omega_c=\pi/4$, a transition with $\Delta\omega=0.02\pi$, and a stopband ripple $\delta_s=0.01$ using Kaiser window method.