Expt 10_ Design of FIR Filter

Design FIR low pass filter whose desired frequency response is
$H(e^{j\omega}) = 1;\ \ -2\pi/5 \leq \omega \leq 2\pi/5$ and 0 otherwise
using Rectangular and Hanning window techniques.

(i) Determine the impulse response {h[n]} for N = 9 and plot the same
(ii) Determine the frequency response $\{H(e^{j\omega})\}$ and plot the same.

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Solution

Desired filter coefficient $\{h_d[n]\}$ is obtained by taking Inverse Discrete Time Fourier Transform (IDTFT) on $H(e^{j\omega})$ and yields $h_d[n] = \sin((2\pi n/5) / \pi n)$

Expected filter coefficients {h]n]} on multiplying with rectangular window function {w[n]} yields the following.

h[0] = 2/5 = 0.4, h[1] = 0.3027, h[2] = 0.0935 , h[3] = - 0.06236 , h[4] = xx, h[5] = - 0.06236, h[6]= 0.0935, h[7] = 0.3027, h[8] = 0.4

Determine the frequency response $H(e^{j\omega})$ by direct substitution of the expression {even symmetry and length is odd integer}

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In python

Note:

```
from scipy.integrate import quad        ## library that support integration function
from scipy import signal                ## library that supports frequency response function
                                            i.e signal.freqz
```

Sample outputs