## Problem 8.11

Given, periodic signal $x[n]$ has DFS:

$x[n] = \sum_{k=-9}^{9} (1+k^2)e^{j(0.08\pi k)n}$. Required to use DTFT to evaluate the convolution: $y[n] = \frac{(\sin(0.15\pi n)}{5\pi n}) * x[n] = h[n] * x[n]$.

Taking DTFT of $h[n]$ yields:

$$H(\omega) = \begin{cases} \frac{1}{5} & |\hat{\omega}| \leq 0.15\pi \\ 1 & 0.15\pi < |\hat{\omega}| \leq \pi \end{cases} \tag{5}$$

$Y(\omega) = H(\omega)X(\omega)$

From the equation of $x[n]$ $\hat{\omega} = 0.8\pi k$, when $k = 0, \hat{\omega} = 0$, when $k = 1, \hat{\omega_1} = 0.08\pi$ and when $k = -1, \hat{\omega_{-1}} = -0.08\pi$. When $k = 2, \hat{\omega_2} = 0.16\pi$ and $k = -2, \hat{\omega_{-2}} = -0.16\pi$.

$\hat{\omega_1}$ and $\hat{\omega_{-1}}$ are below the cutoff frequency $0.15\pi$ and will be considered for the convolution.

Hence, $y[n] = h(n) * x(n) = \frac{1}{5}(1 + 2e^{j(0.08\pi)} + 2e^{-j(0.08\pi)}) = 0.2 + 0.8\cos(0.08\pi n)$