1. A signal, \( x(t) \), is periodic with period \( T = 0.01 \) sec. It’s exponential Fourier series has the coefficients

\[
c_k = \begin{cases} 
2, & k = 0 \\
3, & k = 1, -1 \\
j2, & k = 2 \\
j2, & k = -2 \\
1, & k = 4, -4 \\
0, & \text{otherwise}
\end{cases}
\]

a. Determine the signal, \( x(t) \). Simplify as much as possible.
b. Determine the power in \( x(t) \).
c. Determine the normalized mean square truncation error in the truncated Fourier series

\[
x_N(t) = \sum_{k=-N}^{N} c_k e^{j2\pi k t / T}
\]

for the cases

i. \( N = 1 \).

ii. \( N = 4 \).

d. The signal \( x(t) \) is applied as input to a linear, time-invariant system with the Fourier transform (frequency response) shown below. Determine the filter output, \( y(t) \). (Use the Fourier transform of \( x(t) \), or its Fourier series spectrum.)

\[
H(\omega) = e^{-j\omega t_0} M(\omega), \quad t_0 = 0.002 \text{ sec}
\]

2. The signal \( x(t) = 600 \sin(300t) \) is applied as input to the filter in problem 1d). Find the filter output, \( y(t) \).