1. For a system described by the following differential equation, determine the impulse response in the frequency (Fourier) domain.

\[ y'' + 2y = 6x \]

2. Write the following periodic function as a Fourier series using the complex exponential form

\[ x(t) = \cos(t) \sin(2t) \]

3. Let \( x(t) = (t + 1)e^{-t}u(t) \), determine the Fourier Transform of \( 10x(2t) \).

4. For a system whose impulse response is

\[ h(t) = e^{-2t} \cos(5t)u(t) \]

Determine the response in the time domain for \( x(t) = \cos(t) \).

5. For a system whose impulse response is

\[ h(t) = e^{-t}u(t) \]

Determine the response in the frequency (Fourier) domain for \( x(t) = u(-t) + \cos(t)u(t) \).

6. For the following transfer function

\[ H(s) = \frac{1}{s} + \frac{1}{s+2} \]

Determine the output in the time domain due to an input \( x(t) = \cos(2t) \).

7. Write the following periodic function as a Fourier series using the complex exponential form

\[ x(t) = \cos(2t) + \sin(5t) \]

8. Let \( x(t) = u(t + 1) - u(t - 1) \), determine the Fourier Transform of \( x(t/2) \).

9. For a system whose impulse response is

\[ h(t) = e^{-2t}u(t) \]

Determine the response in the time domain for \( x(t) = \cos(4t + 1) \).
10. For a system whose impulse response is

\[ h(t) = e^{-2t} \sin(t) u(t) \]

Determine the response in the time domain due to an input \( x(t) = \cos(t) \)

11. Write the following periodic function as a Fourier series using the complex exponential form

\[ x(t) = \Re[e^{jt}] + \Im[e^{j2t}] \]

(Re and Im mean real part and imaginary part respectively)

12. Using the definition of the Fourier Transform, derive \( X(\omega) \), where

\[ x(t) = u(-t) - 2u(t) \]

Be sure to show each step, not just the final result.

13. Let \( x(t) = \delta(t) + e^{-t} u(t) \), determine the Fourier Transform of \( 2x(-2t) \).

14. For a system whose impulse response is

\[ h(t) = e^{-(t-1)} u(t) \]

Determine the response in the time domain for \( x(t) = \sin(t) \).