Notes: 1. The exam is closed-book and closed-notes. You are allowed three 8½ x 11 sheets of handwritten notes.

2. You are also allowed L.T. and Fourier transform tables, and L.T. and Fourier transform properties.

3. Show work for partial credit.

4. Please write clearly.

1. Find the exponential Fourier series of the function shown in Figure 1.

(a) Find the exponential Fourier series of the function shown in Figure 1.

(b) Sketch the amplitude and phase spectra of the exponential Fourier series obtained in part (a).

(c) By inspection of spectra in (b), sketch the amplitude and phase of the trigonometric Fourier series.

(d) By inspection of the spectra in (c), write the trigonometric Fourier series of \( x(t) \).

2. Find the Fourier transform of \( x_2(t) \).

(a) Find the Fourier transform of \( x_2(t) \).

(b) Find the Fourier transform of \( x_2(t) \).
3. Find the inverse Fourier transform of

\[ X(\omega) = \begin{cases} 
2 & \text{if } -2 \leq \omega < -1 \\
1 & \text{if } -1 \leq \omega < 0 \\
0 & \text{if } 0 \leq \omega < 1 \\
1 & \text{if } 1 \leq \omega < 2 
\end{cases} \]

4. Draw the Bode plot of the transfer function

\[ H(s) = \frac{10(s+10)}{s(s+2)(s+5)} \]

5. Assume that at the instant the voltage source \( x(t) = E u(t) \) is applied to the circuit in Figure 5, the initial current in the 1H inductor is 2A and the initial voltage across the capacitor is 3V. Find the expression for \( I(s) \).

6. Given the transfer function

\[ H(s) = \frac{6(s+34)}{s^2 + 10s + 34} = \frac{Y(s)}{X(s)} \]

(a) Find the unit step response, i.e., find \( y(t) \) if \( x(t) = u(t) \)

(b) Find the initial value and the final value of the output \( y(t) \) if \( x(t) = u(t) \). Use the initial value and final value theorems.