Problem 1 2.22 a) and b)

Problem 2 2.23

Problem 3 2.42

Problem 4  Determine the Fourier series coefficients of the following continuous time periodic signals of period $T = 2$.

1. 

$$x(t) = t \quad -1 \leq t \leq 1$$

2. 

$$x(t) = \cos \left( \frac{\pi t}{2} \right) \quad -1 \leq t \leq 1$$

Problem 5  A continuous time signal $x(t)$, periodic with period $T = 4$, has the following Fourier series coefficients

$$\hat{x}[k] = \frac{1}{2^{|k|}}$$

Determine $x(t)$.

Problem 6  Let $x(t)$ be a periodic signal with fundamental period $T$ and Fourier series coefficients $\hat{x}[k]$. Derive the Fourier series coefficients of the signal

$$\frac{d}{dt} \{x(t + 2T)\}$$

Problem 7  OW 3.64

Problem 8  Consider the periodic signal of period $T = 6$

$$x(t) = \begin{cases} 
0 & -3 < t < -1 \\
2 & -1 < t < 1 \\
0 & 1 < t < 3 
\end{cases}$$

Consider also the LTI system about which we know the following facts:

1. The frequency response of the system $H(j\omega)$ is zero for $|\omega| > \pi$.

2. The response to an input signal $1 + \cos \left(2\pi(t - 5)/3\right)$ is 4.

3. The response to an input signal $\cos \left(\pi t/3\right)$ is $\pi \cos \left(\pi t/3\right)$.

Determine the output when $y(t)$ when the signal $x(t)$ is applied as input.
Problem 9  Compute the Fourier transform of each of the following signals:

1. \( x(t) = (e^{-2t} \sin(3t)) \, u(t) \)
2. The signal \( x(t) = \delta(t + 1) - \delta(t) + \delta(t - 1) \) considered as a periodic signal of period \( T = 4 \)

Problem 10  Determine the continuous-time signal corresponding to each of the following transforms

1. \( X(j\omega) = \frac{6 \sin(2(\omega + 2))}{\omega + 2} \)
2. \( X(j\omega) = 4(\delta(\omega - 2) + \delta(\omega + 2)) - 2j(\delta(\omega + \pi) - \delta(\omega - \pi)) \)

Problem 11  Answer the questions asked in O&W 4.24-(a) for each of the following signals:

1. \( x_1(t) = \begin{cases} 
0 & t < -4 \\
-1 & -4 < t < -2 \\
t & -2 < t < 2 \\
1 & 2 < t < 4 \\
0 & t > 4 
\end{cases} \)

2. \( x_2(t) = \delta(t + 2) + \delta(t - 4) \)
3. \( x_3(t) = 3\delta(t + 3) + 2(u(t + 1) - u(t - 1)) + 3\delta(t - 3) \).

Problem 12  Let \( X(j\omega) \) denote the Fourier transform of the following signal

\[ x(t) = -2(u(t + 7) - u(t + 5) + u(t + 4) - u(t + 2) - 2(u(t + 1) - u(t - 1)) \]

For this transform answer the questions given in O&W 4.25, parts (b)-(f) plus the following new part (a):

- \( X(j\omega) \) can be written as \( A(j\omega)e^{j\theta(j\omega)} \) where \( A(j\omega) \) and \( \theta(j\omega) \) are real. Find \( \theta(j\omega) \).