

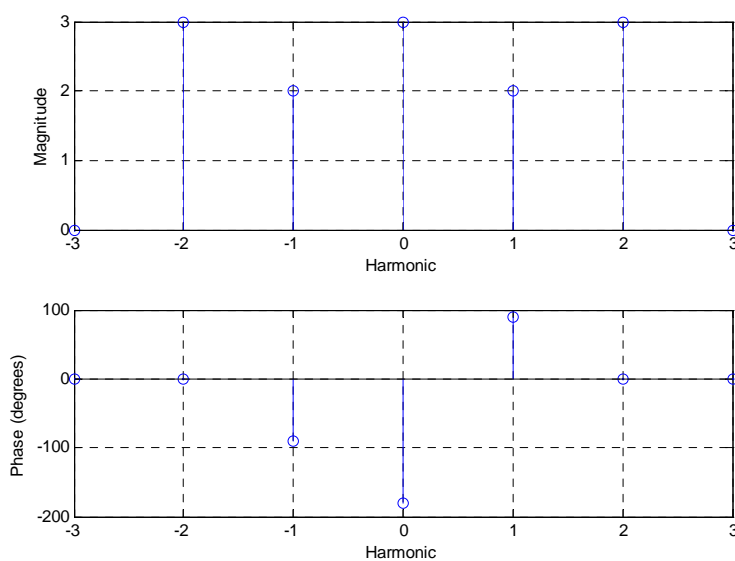
Practice Quiz 7

(no calculators allowed)

1) Assume $x(t)$ is a periodic function with Fourier series representation $x(t) = \sum c_k^x e^{jk\omega_0 t}$. $x(t)$ is the input to an LTI system with output $y(t) = 3\dot{x}(t-2)$. The Fourier series coefficients c_k^y are related to the c_k^x in which of the following ways

- a) $c_k^y = 3jk\omega_0 e^{+jk\omega_0 2} c_k^x$ b) $c_k^y = -3jk\omega_0 e^{-jk\omega_0 2} c_k^x$
 c) $c_k^y = 3jk\omega_0 e^{-jk\omega_0 2} c_k^x$ d) $c_k^y = -3jk\omega_0 e^{+jk\omega_0 2} c_k^x$

Problems 2-5 refer to the following spectrum plot for a signal $x(t)$ with fundamental frequency $\omega_0 = 2$. All angles are multiples of 90 degrees.



2) What is the average value of $x(t)$? a) 13 b) $\frac{13}{7}$ c) $\frac{13}{5}$ d) 3 e) -3

3) What is the average power in $x(t)$? a) 13 b) $\frac{13}{7}$ c) 35 d) 3

4) If $x(t)$ is the input to a system with transfer function

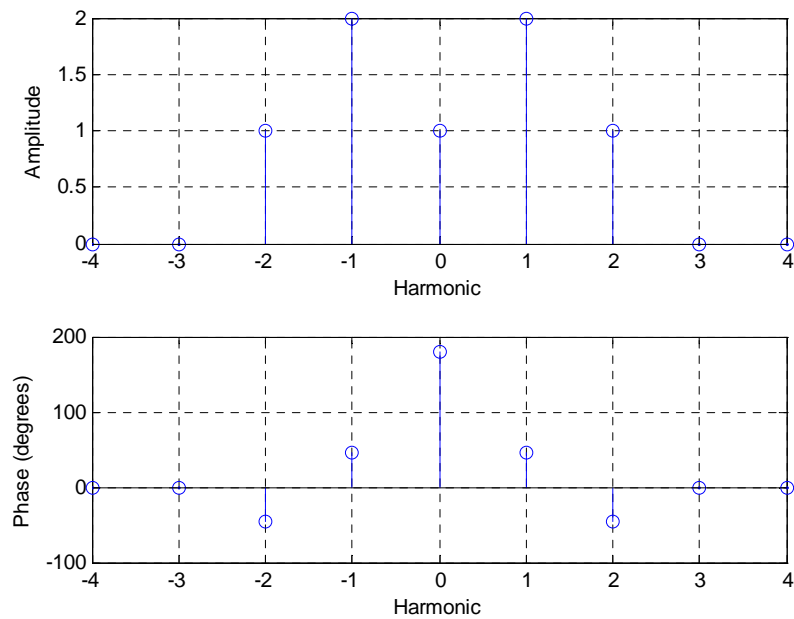
$$H(\omega) = \begin{cases} 2 & 1 < |\omega| < 3 \\ 0 & \text{else} \end{cases}$$

the output $y(t)$ in steady state will be

a) $12\cos(2t)$ b) $4\cos(2t + 90^\circ)$ c) $8\cos(t + 90^\circ)$ d) $8\cos(2t + 90^\circ)$ e) $6\cos(2t)$

5) The average power in $y(t)$ is a) 4 b) 8 c) 16 d) 32

Problems 6-8 refer to the following plot (all angles are multiples of 45 degrees)



6) Is this a valid spectrum plot for a real valued function $x(t)$? a) Yes b) No

7) Assuming the magnitude portion of the spectrum is correct, what is the average power in $x(t)$?

a) 4 b) 7 c) 11 d) 12

8) Assuming the plot is a valid spectrum plot for a real valued function $x(t)$, the average value of $x(t)$ is

a) 1 b) 2 c) $\frac{7}{4}$ d) -1

Problems 9-13 refer to the following Fourier series representation of a periodic signal

$$x(t) = 2 + \sum_{k=-\infty}^{k=\infty} \frac{2}{2 + jk} e^{\frac{jkt}{2}}$$

9) The average value of $x(t)$ is

- a) 1 b) 2 c) 3 d) 4

10) The average power in the DC component of $x(t)$ is

- a) 1 b) 2 c) 4 d) 8 e) 9 f) 18

11) If $x(t)$ is the input to a system with transfer function

$$H(\omega) = \begin{cases} 2 & |\omega| < 0.4 \\ 0 & \text{else} \end{cases}$$

the output $y(t)$ in steady state will be

- a) 0 b) 3 c) 6 d) $1.79 \cos(0.5t - 26.6^\circ)$ e) $6 + 3.58 \cos(0.5t - 26.6^\circ)$

12) If $x(t)$ is the input to a system with transfer function

$$H(\omega) = \begin{cases} 2 & |\omega| > 0.4 \\ 0 & \text{else} \end{cases}$$

the output $y(t)$ in steady state will be

- a) $2x(t)$ b) $2x(t) - 3$ c) $2x(t) - 6$ d) none of these

13) If $x(t)$ is the input to a system with transfer function

$$H(\omega) = \begin{cases} 0 & 0.4 < |\omega| < 0.6 \\ 2 & \text{else} \end{cases}$$

the output $y(t)$ in steady state will be

- a) $1.79 \cos(0.5t - 26.6^\circ)$ b) $3.58 \cos(0.5t - 26.6^\circ)$
c) $2x(t) - 1.79 \cos(0.5t - 26.6^\circ)$ d) $2x(t) - 3.58 \cos(0.5t - 26.6^\circ)$

For problems 14 and 15, assume $x(t) = 1 + 3\sin(2t + 45^\circ)$

14) The average value of $x(t)$ is

- a) 0 b) 1 c) 2 d) 4

15) The average power in $x(t)$ is

- a) 1 b) $\frac{13}{4}$ c) 5.5 d) 19

Problems 16 and 17 refer to the periodic function $x(t)$ defined over one period $T_0 = 3$ as $x(t) = t$ $0 \leq t < 3$ which has the Fourier series representation

$$x(t) = \frac{3}{2} + \sum_{k \neq 0} \frac{3j}{k2\pi} e^{jk\frac{2\pi}{3}t}$$

16) The average power in $x(t)$ is

- a) 0 b) $\frac{3}{2}$ c) $\frac{9}{4}$ d) 3 e) $\frac{9}{2}$

17) If this signal is the input to a transfer function $H(j\omega) = 0.5e^{-j0.25\omega}$, the steady state output will be

- a) $0.5(t - 0.25)$ b) $0.5te^{-j0.25\omega}$ c) $0.5(t + 0.25)$ d) none of these

Answers: 1) c 2) e 3) c 4) d 5) d

6) b 7) c 8) d

9) c 10) e 11) c 12) c 13) d

14) b 15) c 16) d 17) a