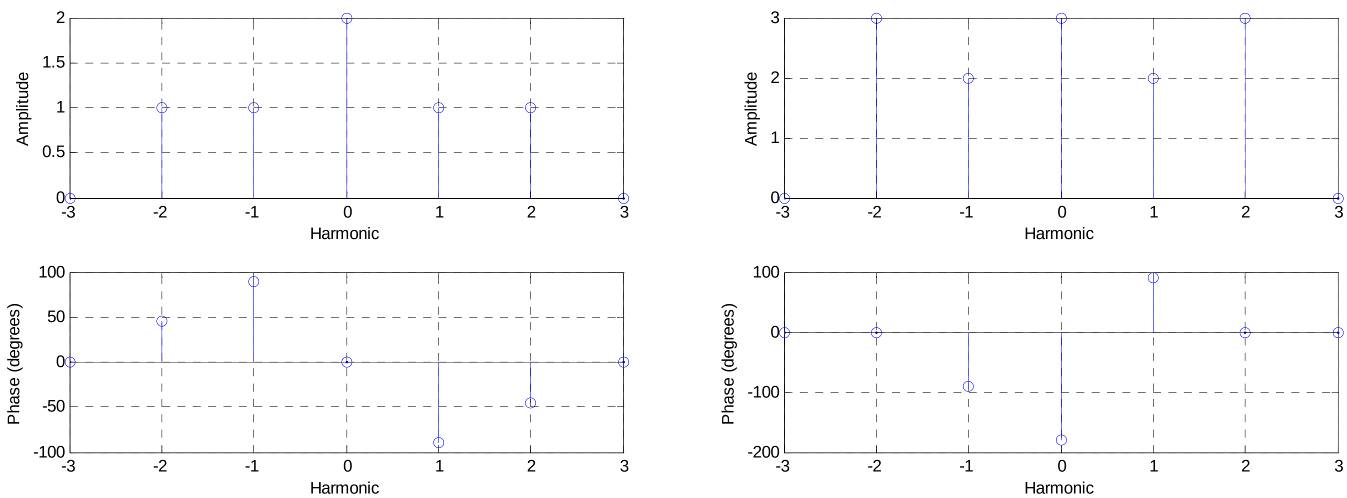
Name________________________________ **CM**____________

Quiz 6
(you can use your calculators)

Questions 1-4 refer to the following spectrum plots. Assume the period of the input is 2 seconds.

The input $x(t)$ to a LTI system has the spectrum shown on the left, while the transfer function of the LTI system has the spectrum on the right (all angles are multiples of 45 degrees). Note that only values of the transfer function at the appropriate frequencies are displayed, i.e., the plot displays $H(k\omega_o)$ as magnitude and phase.



1) The average value of the system output, $y(t)$, is

a) 36 b) 6 c) -6 d) 2

2) The first harmonic of $y(t)$ can be written as

a) $y(t) = -4\cos(\pi t)$ b) $y(t) = 4\cos(2t)$
c) $y(t) = 4\cos(\pi t)$ d) $y(t) = 2\cos(\pi t)$

3) The second harmonic of $y(t)$ can be written as

a) $y(t) = 6\cos(2\pi t - 45^o)$ b) $y(t) = 3\cos(2\pi t + 45^o)$
c) $y(t) = 6\cos(2\pi t + 45^o)$ d) $y(t) = 3\cos(2\pi t - 45^o)$

4) The average power of the output, $y(t)$, is

a) 36 W b) 6 W c) 62 W d) 49 W

Problems 5-8 refer to the following Fourier series representation of a periodic signal

$$x(t) = \sum_{k=-\infty}^{k=\infty} \frac{2}{1+jk} e^{jkt}$$

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

a) 0 b) 1 c) 2 d) 3

6) The fundamental frequency (in Hz) is

a) $\frac{1}{2\pi}$ b) 0.5 c) $\frac{1}{4\pi}$ d) 2

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

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

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

a) $2x(t)$ b) $2x(t)-2$ c) $2x(t)-4$ d) none of these

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

$$H(\omega) = \begin{cases} 2 & 0.5 < |\omega| < 2.5 \\ 0 & else \end{cases}$$

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

a) $5.66\cos(t-45^o) + 3.58\cos(2t-63.4^o)$ b) $2.82\cos(t-45^o) + 1.79\cos(2t-63.4^o)$

c) $4 + 5.66\cos(t-45^o) + 3.58\cos(2t-63.4^o)$ d) $5.66\cos(t+45^o) + 3.58\cos(2t+63.4^o)$

9) Assume $x(t) = 3\cos(2t-5)$ is the input to a system with transfer function

$$H(\omega) = \begin{cases} e^{-j\omega} & |\omega| < 5 \\ 3 & else \end{cases}$$

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

a) $3\cos(2t-5)e^{-j2}$ b) $3\cos(2t-7)$

c) $9\cos(2t-5)$ d) $9\cos(2t-7)$

10) Assume we are going to synthesize a periodic signal $x(t)$ using $x(t) = \sum c_k e^{jk\omega_0 t}$ where $c_k = \frac{j}{1+jk^2}$. Will $x(t)$ be a real function? a) Yes b) No

For problems 11 and 12, assume $c_k = e^{-j\pi k} - e^{-j2\pi k}$ and we want to write this as $c_k = e^{j\alpha}\left(e^{j\beta} - e^{-j\beta}\right)$

11) The value of α is

a) $-\frac{k\pi}{2}$ b) $-\frac{3k\pi}{2}$ c) $-\frac{3k\pi}{4}$ d) none of these

12) The value of β is

a) $\frac{k\pi}{4}$ b) $\frac{k\pi}{2}$ c) $\frac{3k\pi}{2}$ d) $\frac{3k\pi}{4}$ e) none of these

13) If $c_k = \frac{\sin(\frac{k\pi}{4})}{\frac{k}{4}}$**,** then we can write c_k as

a) $c_k = \pi \operatorname{sinc}\left(\frac{k\pi}{4}\right)$ b) $c_k = \operatorname{sinc}\left(\frac{k\pi}{4}\right)$ c) $c_k = \pi \operatorname{sinc}\left(\frac{k}{4}\right)$ d) $c_k = \operatorname{sinc}\left(\frac{k}{4}\right)$

14) If $c_k = \frac{\sin(2k)}{2k}$, then we can write c_k as

a) $c_k = \operatorname{sinc}(\frac{2k}{\pi})$ b) $c_k = \pi \operatorname{sinc}(\frac{2k}{\pi})$ c) $c_k = \operatorname{sinc}(2k)$ d) none of these