ECE-300, Quiz #6

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.
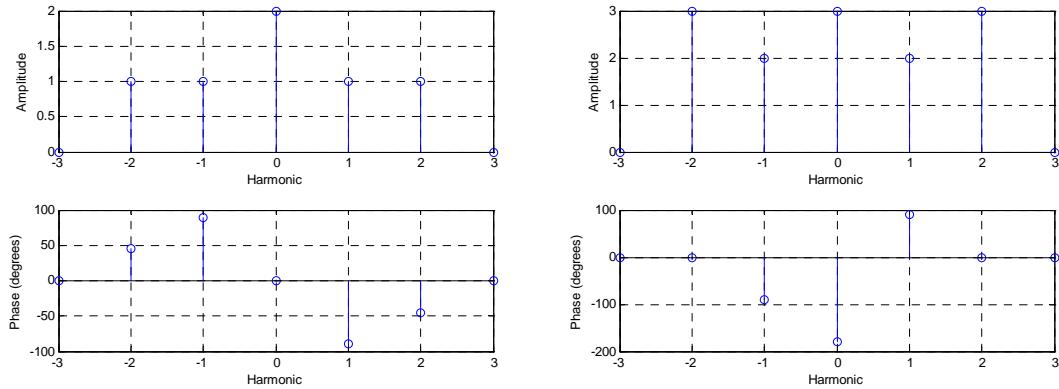


1) The average value of the system output, $y(t)$ , is

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

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

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

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

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

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

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

5) The impulse response for the system below is

a) $h(t) = e^{-2t}u(t)$    b) $h(t) = 2e^{2(t-1)}u(t-1)$    c) $h(t) = 2e^{-2t}u(t-1)$    d) $h(t) = 2e^{2t}u(t)$

$$x(t) \longrightarrow \boxed{\dot{y}(t) - 2y(t) = 2x(t-1)} \longrightarrow y(t)$$
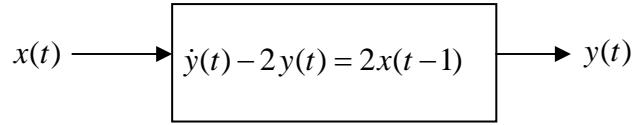
Problems 6 -8 refer to the following mathematical model of a system:

$$\dot{y}(t) + t^2 y(t) = \sin(t+1)x(t-1)$$

6) Is the system linear?            a) Yes   b) No

7) Is the system time-invariant?      a) Yes   b) No

8) Is the system causal?          a) Yes   b) No

9) We can write $\cos(\theta)$ as

a) $\dfrac{e^{j\theta} - e^{-j\theta}}{2}$    b) $\dfrac{e^{j\theta} - e^{-j\theta}}{2j}$    c) $\dfrac{e^{j\theta} + e^{-j\theta}}{2j}$    d) $\dfrac{e^{j\theta} + e^{-j\theta}}{2}$

10) We can write $\sin(\theta)$ as

a) $\dfrac{e^{j\theta} - e^{-j\theta}}{2}$    b) $\dfrac{e^{j\theta} - e^{-j\theta}}{2j}$    c) $\dfrac{e^{j\theta} + e^{-j\theta}}{2j}$    d) $\dfrac{e^{j\theta} + e^{-j\theta}}{2}$

11) Assume we are going to synthesize a periodic signal $x(t)$ using $x(t) = \sum c_k e^{jk\omega_0 t}$

where $c_k = \dfrac{j}{1 + jk^2}$. Will $x(t)$ be a real function?

a) Yes    b) No