**EECS 562**

**Signals and Systems**

**Quiz**

Spring 2017

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**Instructions**

1) Closed Book
2) Closed Notes
3) Be sure and clearly mark your final answer.
4) Where indicated provide justification for your answers. Correct answers with no justification will receive partial/no credit.
5) If you feel that a problem is unclear, contradictory, incomplete, or ambiguous, clearly state the assumptions you used to solve the problem.
1. Let $z_1 = 2 - j2$
   a. 15 pts What is $\text{Re}[z_1]$ 

\[
\text{Re}[z_1] = 2
\]

b. 10 pts What is $\text{Re}[z_1 e^{j2\pi 100t}]$

\[
z_1 e^{j2\pi 100t} = (2 - j2)(\cos(2\pi 100t) + j \sin(2\pi 100t)) = 2(\cos(2\pi 100t) + j \sin(2\pi 100t)) + j (\text{Re}[z_1 e^{j2\pi 100t}])
\]

\[
\text{Re}[z_1 e^{j2\pi 100t}] = 2
\]
2. A linear time invariant system has a frequency transfer function \( H(f) \) given below

Frequency Transfer Function

\[
H(f) = \begin{cases} 
2.0 & \text{if } -1.5 < f < -1.0 \\
1.0 & \text{if } -1.0 < f < -0.5 \\
0.5 & \text{if } 0.5 < f < 1.0 \\
2.0 & \text{if } 1.0 < f < 1.5 
\end{cases}
\]

20 pts The input to this is system is \( x(t) = \cos(500\pi t) \). The system output signal \( y(t) \) is:

i. \( y(t) = \cos(1500\pi t) \)

ii. \( y(t) = \cos(500\pi t) \)

\[\boxed{\text{iii. } y(t) = 2\cos(500\pi t) }\]

iv. or none of the above

Clearly circle the correct answer.
3. A linear time invariant system has a frequency transfer function $H(f)$ given as $H(f) = 2e^{-j2\pi(0.25)t}$.

a. 15 pts Find the impulse response $h(t)$ for this linear time invariant system

$$h(t) = 2\delta(t - 0.25)$$

<table>
<thead>
<tr>
<th>$\delta(t)$</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\delta(t - t_0)$</td>
<td>$\delta(f)$</td>
</tr>
<tr>
<td>$\exp(j2\pi f t_0)$</td>
<td>$\exp(-j2\pi f t_0)$</td>
</tr>
<tr>
<td>$\exp(j2\pi f t)$</td>
<td>$\delta(f - f_0)$</td>
</tr>
<tr>
<td>$\cos(2\pi f t)$</td>
<td>$\frac{1}{2}{\delta(f - f_0) + \delta(f + f_0)}$</td>
</tr>
<tr>
<td>$\sin(2\pi f t)$</td>
<td>$\frac{1}{2j}{\delta(f - f_0) - \delta(f + f_0)}$</td>
</tr>
</tbody>
</table>

b. 10 pts Is this linear time invariant system distortion-less? That is, is there distortion-less transmission of an input signal $x(t)$ through the filter, $H(f)$?

TRUE or FALSE - Clearly circle the correct answer

$$\left| H(f) \right| = \text{constant} \quad \left\{ \begin{array}{c} \text{Distortion less} \\ \angle H(f) = \text{linear (constant delay)} \end{array} \right.$$
4. Given a signal \( x(t) = \cos(2\pi 2000t) + 0.5\cos(2\pi 4000t) \)

a. 15 pts The bandwidth of \( x(t) \) is

i. 2 kHz

\( \underline{\text{ii. 4 kHz}} \)

iii. 6 kHz

iv. or none of the above

\textbf{Clearly circle the correct answer.}

b. 10 pts Using the grid below plot the double sided amplitude spectrum of \( x(t) \).

![Amplitude Spectrum Grid](image-url)