

EE 315 Quiz 2

Spring 2005

April 8, 2005

Name: _____

Problem Number	Maximum Points	Your Score
1	12	
2	15	
3	15	
4	18	
Total	60	

(1) Parts (a) and (b) are independent.

(a) (6) Consider a continuous-time signal $x(t)$ that is periodic with period 6 and Fourier series coefficients $a_k = |k|$ for $|k| \leq 2$ and $a_k = 0$ for $|k| > 2$. Determine $x(t)$

(b) (6) Consider the discrete-time system $x[n]$ that is periodic with period 8 and Fourier series coefficients $a_k = \cos(\frac{k\pi}{4}) + \cos(\frac{3k\pi}{4})$. Determine $x[n]$ for all n .

(2) Parts (a) and (b) are independent.

(a) Consider a continuous-time, LTI system with impulse response

$$h(t) = \frac{\sin 5t}{t}.$$

(i) (3) Determine the frequency response of the system $H(j\omega)$.

(ii) (6) Determine the output when the input is $x(t) = \cos 2t + 2 \sin 4t + 3 \cos 6t$.

(b) (6) For an aperiodic, discrete-time signal $x[n]$, its Fourier transform is periodic with period 2π . Show why this is true.

(3) Consider a discrete-time signal $x[n] = 2\delta[n + 1] + 4\delta[n] - 2\delta[n - 1] + 3\delta[n - 3]$. Without explicitly evaluating the Fourier transform, determine the following. Please make sure your reasoning is clear.

(a) (3) $X(e^{j2\pi})$.

(b) (3) $X(e^{j3\pi})$.

(c) (3) $\int_{-\pi}^{\pi} X(e^{j\omega})e^{-j2\omega}d\omega$.

(d) (6) $\int_{-\pi}^{\pi} \left| \frac{dX(e^{j\omega})}{d\omega} \right|^2 d\omega$.

(4) Consider the continuous-time signal $x(t)$ with Fourier transform

$$X(j\omega) = \begin{cases} 1 & |\omega| \leq 20\pi \\ 0 & |\omega| > 20\pi. \end{cases}$$

It would be helpful to sketch $X(j\omega)$. For each of the following signals, (i) determine a mathematical expression for the Fourier transform and (ii) sketch the magnitude of the Fourier transform.

(a) (6) $y(t) = x(t) - x(t - 2000)$.

(b) (6) $p(t) = x(t) \cdot x(t/2)$. Hint: Let $r(t) = x(t/2)$. Sketch $R(j\omega)$.

(c) (6) $s(t) = \frac{d^2}{dt^2}x(t - 5)$. Hint: Let $q(t) = x(t - 5)$. Determine and sketch $Q(j\omega)$.