King Fahd University of Petroleum & Minerals

Electrical Engineering Department

EE207: Signals & Systems (121)

Quiz 5: Fourier Transform and Applications

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Serial # ..0..

-1 points for not writing your serial #

Name: KEY

Tables are attached

Given $e^{-|t|} \overset{\mathcal{F}}{\leftrightarrow} \frac{2}{\omega^2+1}$

Find the Fourier transform of the following $\frac{1}{2\pi(t^2+1)}$

By duality $F(t) = 2\pi f(-\omega)$

$\Rightarrow \frac{2}{t^2+1} \longleftrightarrow 2\pi e^{-|-\omega|}$

By linearity $\Rightarrow \frac{1}{2\pi(t^2+1)} \longleftrightarrow \boxed{\frac{1}{2} e^{-|\omega|}}$

Consider a linear, time-invariant system with impulse response $h(t) = 0.5\frac{\sin(2t)}{t} = \frac{\sin(2t)}{2t} = \mathrm{sinc}(2t)$

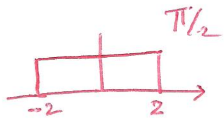
Find the system output if the input is $x(t) = \cos(t) + \sin(3t)$

Using Inverse Fourier Transform. $\frac{\beta}{\pi}\mathrm{sinc}(\beta t) \leftrightarrow \mathrm{rect}\left(\frac{\omega}{2\beta}\right)$

$\mathrm{sinc}(\beta t) \leftrightarrow \frac{\pi}{\beta}\mathrm{rect}\left(\frac{\omega}{2\beta}\right)$

only frequencies < 2 rad/sec will pass

$\mathrm{sinc}(2t) \leftrightarrow \frac{\pi}{2}\mathrm{rect}\left(\frac{\omega}{4}\right)$



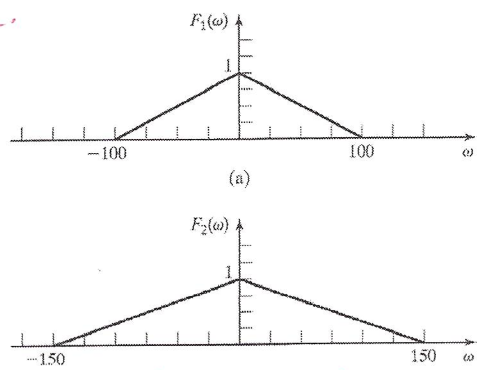
$$\boxed{y(t) = \frac{\pi}{2}\cos(t)}$$

The spectrum of two signals are shown in the Figure, write the relationship between the two signals in the time domain. i.e. write the relation between $f_1(t)$ and $f_2(t)$.

$F_2(\omega) = F_1\left(\frac{\omega}{1.5}\right)$ By inspection.

$f_2(t) = \mathcal{F}^{-1}\left[1.5 \frac{1}{|1.5|} F_1\left(\frac{\omega}{1.5}\right)\right]$

$$\boxed{f_2(t) = 1.5\, f_1(1.5t)}$$



Time Scaling. $f(at) \leftrightarrow \frac{1}{|a|} F\left(\frac{\omega}{a}\right)$

The first two parts are HW problems

Good luck, Dr. Ali Muqaibel