Class - B.Tech (ECE) 2nd yr.

Sub: Signal & System (9/5/2020)

Class Subject	Class Work Forecast	Home Work
	Differentiation in Time Domain	
*	This property is applicable if and only if the derivative of $x(t)$ is fourier transformable.	
	$\frac{d}{dt}x(t) \xleftrightarrow{F} j2\pi f X(f)$	
	Integration in Time Domain	
*	Integration in time Domain is equivalent to dividing the fourier the fourier transform by $(j2\pi f)$	

* If $x(t) \xleftrightarrow{F} X(f)$ and provided that $X(0) = 0$

$$\int_{-\infty}^{t} x(\lambda)\,d\lambda \xleftrightarrow{F} \frac{1}{j2\pi f} X(f)$$

Multiplication in Time Domain :

* The multiplication theorem states that :

If $x_1(t) \xleftrightarrow{F} X_1(f)$ and

$x_2(t) \xleftrightarrow{F} X_1(f)$ are

the two fourier transform pair then:

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$x_1(t) \cdot x_2(t) \xleftrightarrow{F}$

$$\int_{-\infty}^{\infty} X_1(\tau) \cdot X_2(f-\tau)\, d\tau$$

* This means that multiplication of two signals in time domain gets transformed into convolution of the fourier transform

$x_1(t) \cdot x_2(t) \xleftrightarrow{F}$

$X_1(f) * X_2(f)$

Convolution in Time Domain

This property states that the convolutions of signals in the time domain will be transformed into the multiplications of their fourier tranforms in the frequency domain

i.e.

$$x_1(t) * x_2(t) \xleftrightarrow{F} X_1(f) \cdot X_2(f)$$