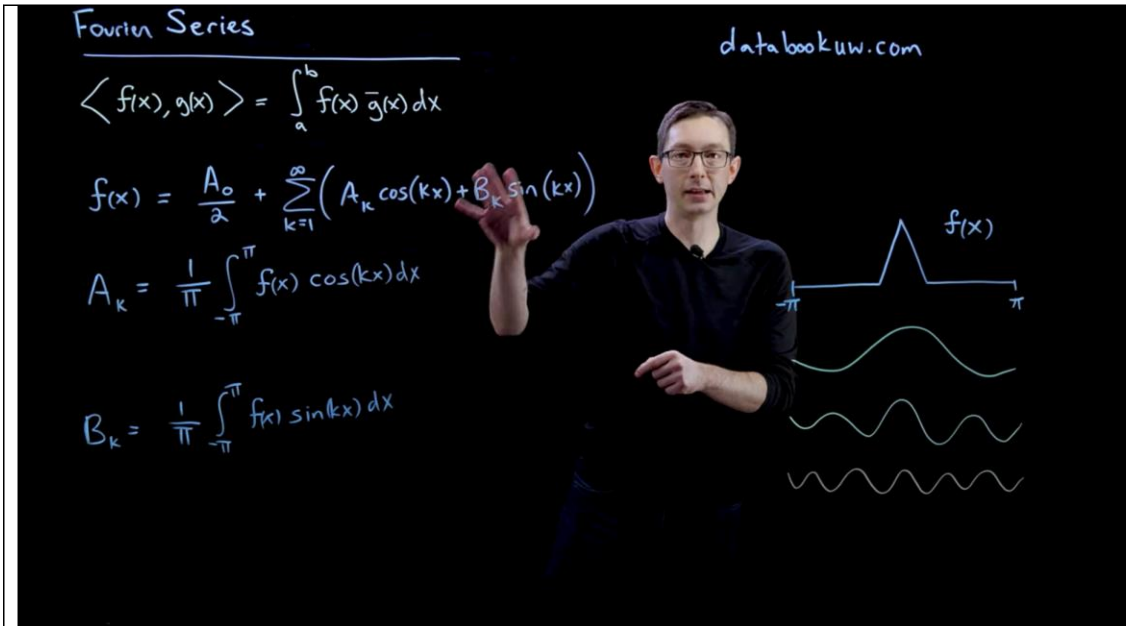
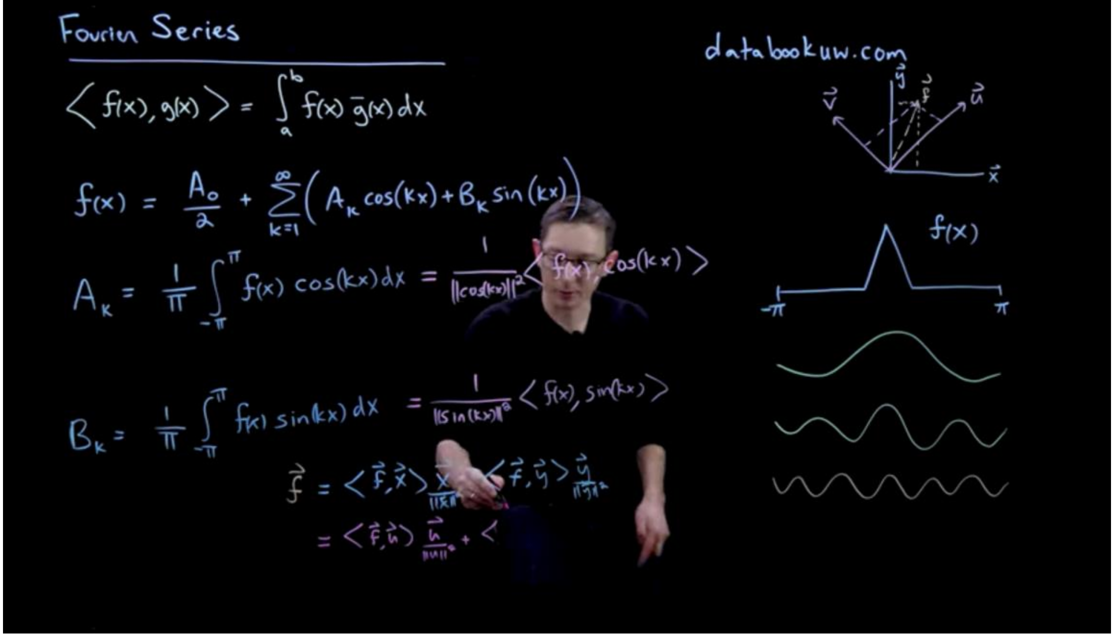
DAILY ASSESSMENT FORMAT

Date:	**25/05/2020**	**Name:**	**Apeksha S Shetty**
Course:	**DIGITAL SIGNAL PROCESSING**	**USN:**	**4AL16EC006**
Topic:	**Introduction to Fourier Series & Fourier Transform** **Inner Product in Hilbert Transform** **Complex Fourier Series**	**Semester & Section:**	**8th sem A**
Github Repository:	**Apeksha-97**		

FORENOON SESSION DETAILS
Image of session 


Fourier Series
databookuw.com
$\langle f(x), g(x) \rangle = \int_a^b f(x)\bar{g}(x)\,dx$
$f(x) = \frac{A_0}{2} + \sum_{k=1}^{\infty}\left(A_k\cos(kx) + B_k\sin(kx)\right)$
$A_k = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos(kx)\,dx$
$B_k = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin(kx)\,dx$
f(x)
$-\pi$
π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$\vec{f} = \langle \vec{f}, \vec{x}\rangle \frac{\vec{x}}{\|\vec{x}\|^2} + \langle \vec{f}, \vec{y}\rangle \frac{\vec{y}}{\|\vec{y}\|^2}$
$= \langle \vec{f}, \vec{u}\rangle \frac{\vec{u}}{\|\vec{u}\|^2} + \langle$
f(x)
$-\pi$
π

25/May

fourier Transform (& Wavelets)

-> Cordinate transform

$u_t = \alpha \nabla^2 u$

SVD = data driven FFT

Fast fourier transform (FFT) -> all the modern digital communication depends on it.

fourier series

$$f(t) = \frac{1}{2} a_0 + \sum_{k=1}^{\infty} (a_k \cos 2\pi k t + b_k \sin 2\pi k t)$$

periodic function

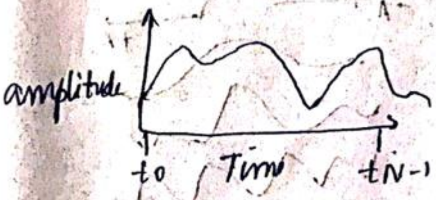
$$X(F) = \int_{-\infty}^{\infty} x(t)\, e^{-j2\pi F t}\, dt \Big\} \rightarrow \text{one complex coefficient per frequency}$$

$x(t)$ = function

$e^{-j2\pi F t} dt$ = analyzing f^n sinusoids

$$\left.\begin{aligned} X_a(F) &= \int_{-\infty}^{\infty} x(t) \cos 2\pi F t\, dt \\ X_b(F) &= \int_{-\infty}^{\infty} x(t) \sin 2\pi F t\, dt \end{aligned}\right\} \rightarrow \text{two real coefficients per frequency}$$

$$X(F) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi F t}\, dt \rightarrow \text{continuous}$$



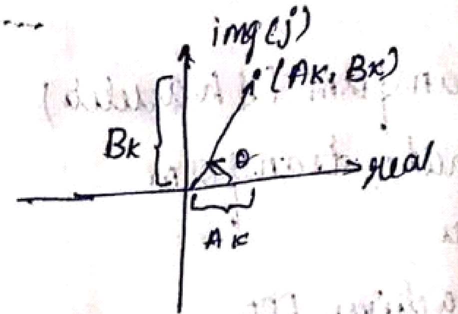
$$X_k = \sum_{n=0}^{N-1} x_n \cdot e^{-\frac{j 2\pi k n}{N}} \rightarrow \text{discrete}$$

$$X_k = x_0 e^{-b_0 j} + x_1 e^{-b_1 j} + \dots + x_n e^{-b_{N-1} j}$$

$$e^{jx} = \cos x + j \sin x$$

$$X_K = x_0\left[\cos(-b_0) + j\sin(-b_0)\right] + \cdots$$

$$X_K = A_K + B_K j$$



$$Mag = \sqrt{A_K^2 + B_K^2}$$

$$\theta = \tan^{-1}\frac{B_K}{A_K}$$

] Sine wave = 1 Hz, Amplitude = 1

Sampling frequency : 8 Hz

\# Samples (N) = 8

Ans :- $X_K = \sum_{n=0}^{N-1} \cdot e^{\frac{-j2\pi kn}{N}}$

$x_0 = 0$

$x_1 = 0.707$

$x_2 = 1$

$x_3 = 0.707$

$x_4 = 0$

$x_5 = -0.707$

$x_6 = -1$

$x_7 = -0.707$

$$X_1 = 0 \cdot e^{\frac{-j2\pi(1)(0)}{8}} + 0.707 \cdot e^{\frac{-j2\pi(1)(1)}{8}} + 1 \cdot e^{\frac{-j2\pi(1)(2)}{8}} + \cdots$$

$$X_1 = 0 + 0.707\left[\cos(-\pi/4) + j\sin(-\pi/4)\right] + 1\left[\cos(-\pi/2) + j\sin(-\pi/2)\right] + \cdots$$

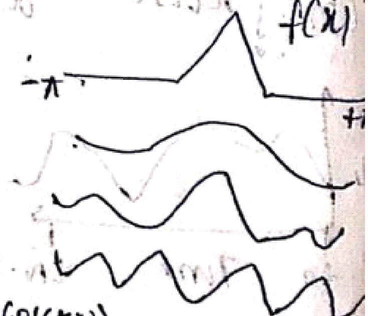
$$X_1 = 0 + (0.5 - 0.5j) + (-j) + (-0.5 - 0.5j) + (0.5 - 0.5j) + (-j) + (-0.5 - 0.5j)$$

$$X_1 = -4j$$

$$X_2 = 0 \cdot e^{\frac{-j2\pi(2)(0)}{8}} + 0.707 e^{\frac{-j2\pi(2)(1)}{}}$$

Fourier series (Part I)

$$\langle f(x), g(x)\rangle = \int_a^b f(x)\bar{g}(x)\,dx$$



$$f(x) = \frac{A_0}{2} + \sum_{k=1}^{\infty}\left(A_K\cos(kx) + B_K\sin(kx)\right)$$

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$$\vec{I} = \langle \vec{f}, \vec{x}\rangle\frac{\vec{x}}{\|x\|^2} + \langle \vec{f}, \vec{y}\rangle\frac{\vec{y}}{\|y\|^2}$$

Complex fourier series