

DAILY ASSESSMENT FORMAT

Date:	26-05-2020	Name:	MOUNITHA D M
Course:	Digital Signal Processing	USN:	4AL17EC055
Topic:	Fourier Transform, Fourier Series	Semester & Section:	6 TH SEM "A" SEC
Github Repository:	Mounitha_-ec055		

FORENOON SESSION DETAILS

Image of session

The Fourier Transform

$f(x) = \sum_{k=-\infty}^{\infty} c_k e^{i k \pi x / L}$ $\omega_c = \frac{k \pi}{L} = K \Delta \omega$ $\Delta \omega = \frac{\pi}{L}$

$c_k = \frac{1}{2\pi} \langle f(x), \psi_k \rangle = \frac{1}{2\pi} \int_{-L}^L f(x) \underbrace{e^{-i k \pi x / L}}_{\psi_k} dx$

$f(x) = \lim_{\substack{\Delta \omega \rightarrow 0 \\ (L \rightarrow \infty)}} \sum_{k=-\infty}^{\infty} \frac{\Delta \omega}{2\pi} \int_{-\pi/\Delta \omega}^{\pi/\Delta \omega} f(\xi) e^{-i k \omega \xi} d\xi e^{i k \omega x}$

$= \int_{-\infty}^{\infty} \underbrace{\frac{1}{2\pi} \int_{-\infty}^{\infty} f(\xi) e^{-i \omega \xi} d\xi}_{\hat{f}(\omega)} e^{i \omega x} d\omega$

$\hat{f}(\omega) = \mathcal{F}(f(x)) = \int_{-\infty}^{\infty} f(x) e^{-i \omega x} dx$

$f(x) = \mathcal{F}^{-1}(\hat{f}(\omega)) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) e^{i \omega x} d\omega$

The Fourier Transform and Convolution Integrals

$\mathcal{F}(f * g) = \mathcal{F}(f) \mathcal{F}(g) = \hat{f} \hat{g}$

$\mathcal{F}^{-1}(\hat{f} \hat{g})(x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) \hat{g}(\omega) e^{i \omega x} d\omega$

$= \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) \left(\int_{-\infty}^{\infty} g(y) e^{-i \omega y} dy \right) e^{i \omega x} d\omega$

$= \left(\frac{1}{2\pi} \int_{-\infty}^{\infty} g(y) \int_{-\infty}^{\infty} \hat{f}(\omega) e^{i \omega (x-y)} d\omega dy \right)$

$= \int_{-\infty}^{\infty} g(y) f(x-y) dy$

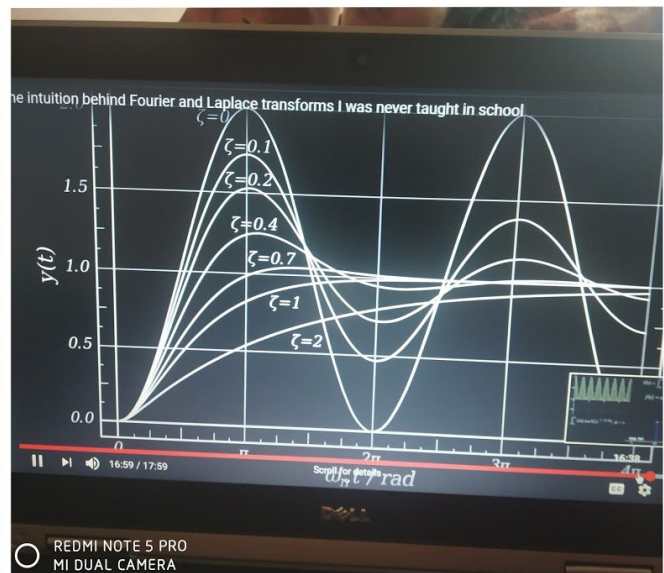
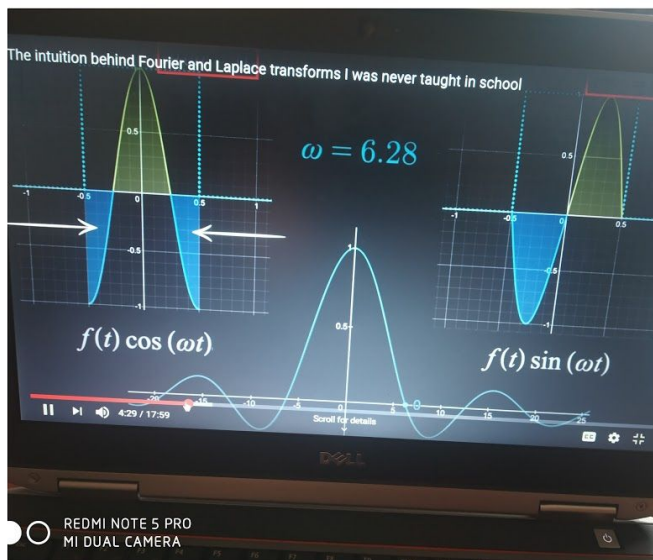
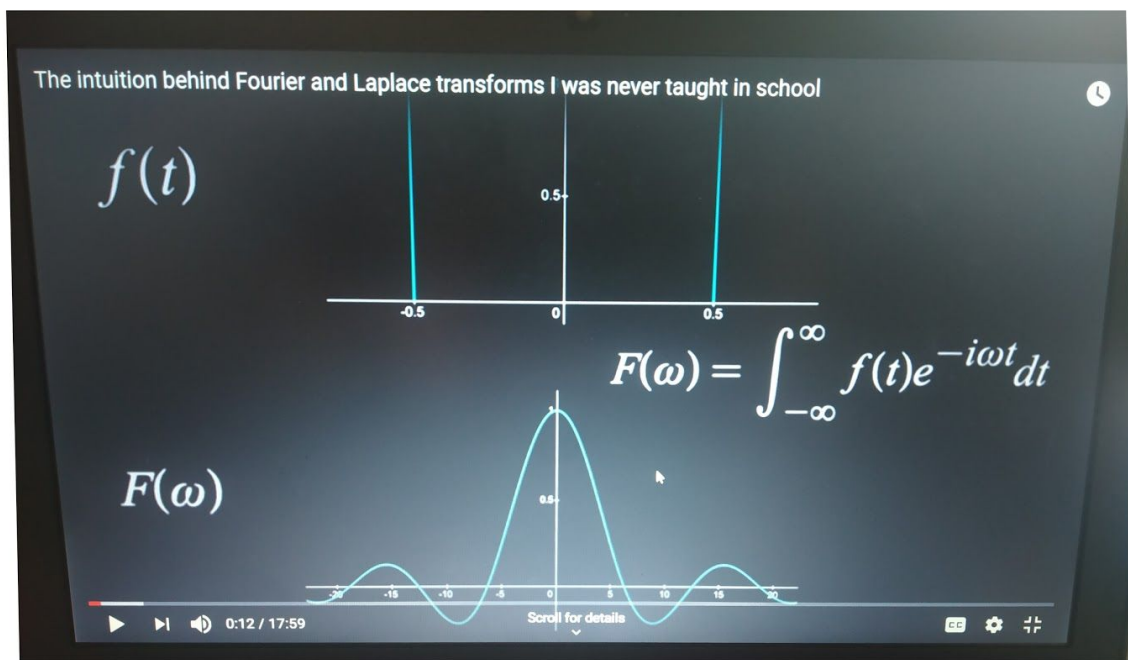
$= f * g$

$(f * g) = \int_{-\infty}^{\infty} f(x-\xi) g(\xi) d\xi$

$\hat{f}(\omega) = \mathcal{F}(f(x)) = \int_{-\infty}^{\infty} f(x) e^{-i \omega x} dx$

$f(x) = \mathcal{F}^{-1}(\hat{f}(\omega)) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) e^{i \omega x} d\omega$

Fourier Transform Pair



Lecture 46- Applications of Z-transform- II

We know that

$$Z(1) = \frac{z}{z-1}, \quad |z| > 1$$

$$Z(n) = \frac{z}{(z-1)^2}, \quad Z(n^2) = \frac{z^2 + z}{(z-1)^3}.$$

Hence

$$\begin{aligned} Z(n^3) &= -z \frac{d}{dz} Z(n^2) \\ &= \frac{z^3 + 4z^2 + z}{(z-1)^4}. \end{aligned}$$

The screenshot shows a MATLAB environment with a script editor and a command window. The script editor displays the following code:

```

8 - syms n wo;
9 - % Signal
10 - a = n + 1;
11 - disp('The input equation is');
12 - disp(a);
13 - % taking Z-Transform
14 - b = ztrans(a);

```

The Command Window shows the execution results:

```

>> syms n;
>>
>> a = n+1;
>>
>> b = ztrans(a);
>> disp(b)
z/(z - 1) + z/(z - 1)^2

>> pretty(b)
      z      z
      ---- + ----
      z - 1      2
              (z - 1)

```

The workspace window on the left shows the variables defined in the script:

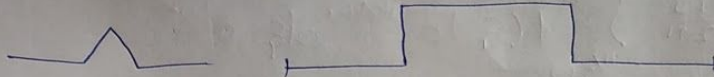
Name	Value
a	1x1 sym
b	1x1 sym
n	1x1 sym

①

DSP → Day 2

26/5/2020

Fourier Series Gibbs phenomena using python



$$f(x) \cong \sum_{k=0}^{100} a_k \cos\left(\frac{2\pi k x}{L}\right) + b_k \sin\left(\frac{2\pi k x}{L}\right)$$

$$a_k = \langle f(x), \cos\left(\frac{2\pi k x}{L}\right) \rangle$$

$$b_k = \langle f(x), \sin\left(\frac{2\pi k x}{L}\right) \rangle$$

import numpy as np

import matplotlib.pyplot as plt

plt.rcParams['figure.figsize'] = [0.5]

plt.rcParams.update({'font.size': 10})

dx = 0.01

L = 2*np.pi

x = np.arange(0, L+dx, dx)

n = len(x)

nquant = int(np.floor(n/4))

f = np.zeros_like(x)

f[nquant: 3*nquant] = 1

A0 = np.sum(f * np.ones_like(x)) * dx * 2/L

fFS = A0/2 * np.ones_like(f)

for k in range(1, 101):

Ak = np.sum(f * np.cos(2*np.pi * k * x/L)) * dx * 2/L

Bk = np.sum(f * np.sin(2*np.pi * k * x/L)) * dx * 2/L

fFS = fFS + Ak * np.cos(2*k*np.pi*x/L) + Bk * np.sin

(2*k*np.pi*x/L)

plt.plot(x, f, color='k', linewidth=2)

plt.plot(x, fFS, 'r', color='r', linewidth=1.5)

plt.show()

Fourier Transform



$$f(x) = \sum_{k=-\infty}^{\infty} C_k e^{ik\pi x/L}$$

$$C_k = \frac{1}{2\pi} \int_{-L}^L f(x) \psi_k \Rightarrow \frac{1}{2L} \int_{-L}^L f(x) e^{-ik\pi x/L} dx$$

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$$\omega_k = k\pi/L = k\Delta\omega \quad \Delta\omega = \pi/L$$

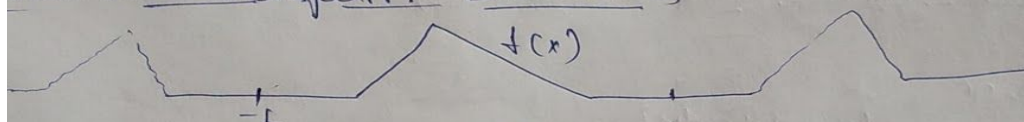
$$f(x) = \lim_{\substack{\Delta\omega \rightarrow 0 \\ (L \rightarrow \infty)}} \sum_{k=-\infty}^{\infty} \frac{\Delta\omega}{2\pi} \int_{-\pi/2\omega}^{\pi/2\omega} f(\xi) e^{-jK\Delta\omega} d\xi e^{j\omega_k x}$$

$$= \int_{-\infty}^{\infty} \underbrace{\frac{1}{2\pi} \int_{-\infty}^{\infty} f(\xi) e^{j\omega\xi} d\xi}_{f(\omega)} e^{j\omega x} d\omega$$

$$\hat{f}(\omega) = F(f(x)) = \int_{-\infty}^{\infty} f(x) e^{-j\omega x} dx$$

$$f(x) = F^{-1}(\hat{f}(\omega)) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) e^{j\omega x} d\omega$$

Fourier Transform Derivatives



$$\hat{f}(\omega) = F(f(x)) = \int_{-\infty}^{\infty} f(x) e^{-j\omega x} dx$$

$$f(x) = F^{-1}(\hat{f}(\omega)) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) e^{j\omega x} d\omega$$

$$F\left(\frac{d}{dx} f(x)\right) = \int_{-\infty}^{\infty} \underbrace{\frac{df}{dx}}_u e^{j\omega x} dx$$

$$= \left[\underbrace{f(x)}_u \underbrace{e^{-j\omega x}}_v \right]_{-\infty}^{\infty} - \int_{-\infty}^{\infty} \underbrace{f(x)}_u \underbrace{(-\omega e^{-j\omega x})}_{\frac{dv}{dx}} dx$$

$$= i\omega \underbrace{\int_{-\infty}^{\infty} f(x) e^{-j\omega x} dx}_{F(f(x))} = \underbrace{i\omega F(f(x))}_{F\left(\frac{df}{dx}\right)}$$

$$u_{tt} = c^2 u_{xx} \xrightarrow{F} \hat{u}_{tt} = -\omega^2 \hat{u}$$

(PDE) (ODE)

$$u(x, t) \xrightarrow{F} \hat{u}(\omega, t)$$

Fourier Transform and Convolution

(3)

$$(f * g)(x) = \int_{-\infty}^{\infty} f(x-\xi) g(\xi) d\xi$$

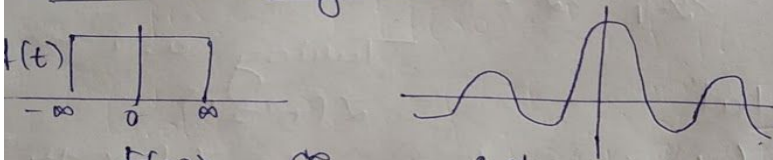
$\underbrace{\quad\quad\quad}_{f(x)} \quad \underbrace{\quad\quad\quad}_{g(x)} \quad \xrightarrow{L \rightarrow \infty}$

$$F[f * g] = F[f] F[g] = \hat{f} \hat{g} \quad \Delta \omega \rightarrow 0 \quad \hat{f}(\omega) = F[f(x)] = \int_{-\infty}^{\infty} f(x) e^{-i\omega x} dx$$

$$f(x) = F^{-1}(\hat{f}(\omega)) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) e^{i\omega x} d\omega$$

$$\begin{aligned} F^{-1}(\hat{f} \hat{g})(x) &= \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) \hat{g}(\omega) e^{i\omega x} d\omega \\ &= \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\omega) \left(\int_{-\infty}^{\infty} g(y) e^{-i\omega y} dy \right) e^{i\omega x} d\omega \\ &= \frac{1}{2\pi} \int_{-\infty}^{\infty} g(y) \int_{-\infty}^{\infty} \hat{f}(\omega) e^{i\omega(x-y)} d\omega dy \\ &= \int_{-\infty}^{\infty} g(y) f(x-y) dy \\ &= f * g. \end{aligned}$$

Intuition of Fourier



$$\begin{aligned} F(\omega) &= \int_{-\infty}^{\infty} f(t) e^{-i\omega t} dt \\ e^{-i\omega t} &= \cos(-\omega t) + i \sin(-\omega t) \end{aligned}$$

$$F(\omega) = \int_{-\infty}^{\infty} f(t) (\cos(\omega t) - i \sin(\omega t)) dt$$

$$F(\omega) = \int_{-\infty}^{\infty} f(t) \cos(\omega t) dt - i \int_{-\infty}^{\infty} f(t) \sin(\omega t) dt$$

Fourier : $F(\omega) = \int_{-\infty}^{\infty} f(t) e^{-i\omega t} dt$

Laplace : $f(s) = \int_0^{\infty} f(t) e^{-(\alpha + i\omega)t} dt$

$$F(s) = \int_0^{\infty} f(t) e^{-i\omega t} e^{-\alpha t} dt$$

Implementation of Laplace Transform using MATLAB

(11)

```

clc
clear all;
Sym F S x;
F = (S+29)/(S^3+4*S^2+9*S+36)
ilaplace(F,x)
→ F =
    (S+29)/(S^3+4*S^2+9*S+36)
ans =
    Exp(-4*x) - cos(3*x) + (5*sin(3*x))/2
    
```

Application of Z transform

$$\mathcal{Z}^{-1}\left(\frac{z^3-20z}{(z-2)^3(z-4)}\right) = -\frac{1}{2}4^n + \frac{1}{8}2^n + n^2 2^n$$

$$\frac{z^2-20}{(z-2)^3(z-4)} = \frac{U(z)}{z} = \frac{A}{z-4} + \frac{B}{z-2} + \frac{C}{(z-2)^2} + \frac{D(2z+4)}{(z-2)^3}$$

Taking $a=2$ we get
 $\mathcal{Z}(n^2 2^n)$

$$\mathcal{Z}(na^n) = \frac{az}{(z-a)^2} \quad |z| > |a|$$

$$\mathcal{Z}(n^2 a^n) = \frac{2az}{(z-a)^3}$$

$$\text{we have } \mathcal{Z}(n^2 a^n) = \frac{a(z^2+az)}{(z-a)^3} = \frac{z(az+a^2)}{(z-a)^3}$$

$$z^2-20 = A(z-2)^3 + B(z-2)^2(z-4) + C(z-2)(z-4) + D(2z+4) \quad (1)$$

Putting $z=2$, we get $-16 = D(8)(-2) \Rightarrow D=1$

Putting $z=0$ in Eq (1)

$$-20 = -8A - 16B + 8C - 16D$$

$$-20 = -8(-\frac{1}{2}) - 16(\frac{1}{2}) + 8C - 16$$

$$\text{or } -20 - 4 + 8 + 16 = 8C - 16 \quad \text{Hence } \frac{U(z)}{z} = -\frac{1}{2(z-4)} + \frac{1}{2(z-2)} + \frac{(2z+4)}{(z-2)^3}$$

$\Rightarrow C=0$

$$U(z) = -\frac{1}{2} \frac{z}{z-1} + \frac{1}{2} \frac{z}{z-2} + \frac{2z^2+4z}{(z-2)^3}$$

$$U_n = -\frac{1}{2} u^n + \frac{1}{2} \cdot 2^n + n^2 2^n \quad |z| > 4$$

find the Z transform of sequence using Matlab

>> syms n;

a = n + 1;

>> b = ztrans(a);

>> disp(b)

$$z/(z-1) + z/(z-1)^2$$

>> pretty(b)

$$\gg \frac{z}{z-1} + \frac{z}{(z-1)^2}$$

$$a = \sin(w * n);$$

$$b = ztrans(a);$$

disp(b)

$$(z * \sin(w)) / (z^2 - 2 * \cos(w) * z + 1)$$

>> pretty(b)

$$\frac{z(\sin(w))}{z^2 - \cos(w)z + 1}$$

$$z^2 - \cos(w)z + 1$$

DATE	26-05-2020	Name:	MOUNITHA DM
Course:	PYTHON	USN:	4AL17EC055
Topic:	Application 4:Build a Personal website with Python and Flask	Semester & Section:	6 TH SEM "A" SEC

AFTERNOON SESSION DETAILS

Image of session

The screenshot shows a code editor window titled 'script1.py - C:\pp\Demo\d_flask_website\Demo - Atom'. The editor displays the following Python code:

```

1  from flask import Flask
2
3  app=Flask(__name__)
4
5  @app.route('/')
6  def home():
7      return "Homepage here!"
8
9  @app.route('/about/')
10 def about():
11     return "Website content goes here!"
12
13 if __name__ == "__main__":

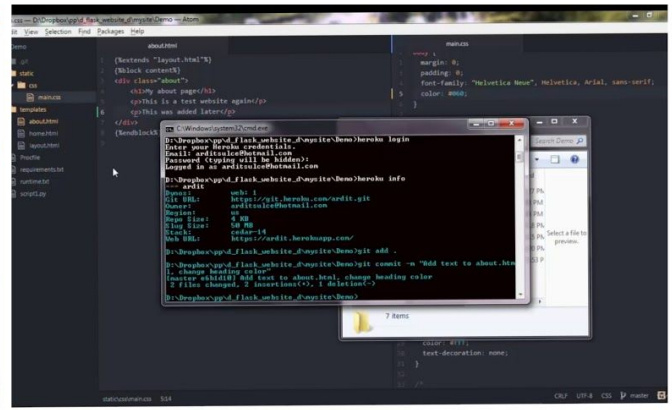
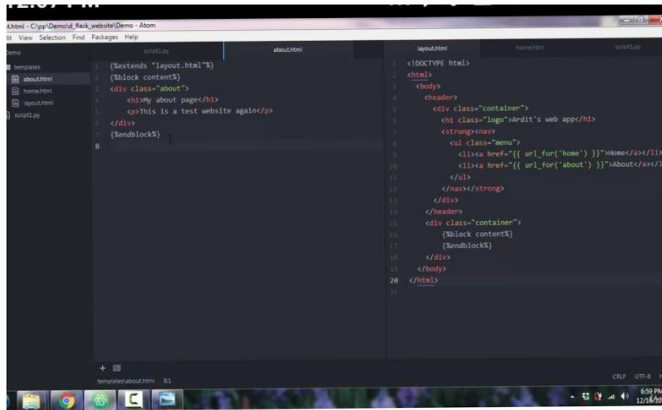
```

The terminal output below the code shows the following:

```

127.0.0.1 - - [13/Dec/2015 22:35:37] "GET /about HTTP/1.1" 301 -
127.0.0.1 - - [13/Dec/2015 22:35:37] "GET /about/ HTTP/1.1" 200 -
* Detected change in 'C:\pp\Demo\d_flask_website\Demo\script1.py', reloading
* Restarting with stat
Traceback (most recent call last):
  File ".\script1.py", line 9, in <module>
    @app.route('/about/')
  File "C:\Users\adi\AppData\Local\Programs\Python\Python35\lib\site-packages\flask\app.py", line 1013, in decorator
    self.add_url_rule(rule, endpoint, f, **options)
  File "C:\Users\adi\AppData\Local\Programs\Python\Python35\lib\site-packages\flask\app.py", line 62, in wrapper_func
    return f(self, *args, **kwargs)
  File "C:\Users\adi\AppData\Local\Programs\Python\Python35\lib\site-packages\flask\app.py", line 984, in add_url_rule
    'existing endpoint function: %s' % endpoint)
AssertionError: View function mapping is overwriting an existing endpoint function: home
PS C:\pp\Demo\d_flask_website\Demo>

```



Lectures More



Video - 00:13 mins

156 Scheduling a Python Program on a Server Article

Section 20 - Application 4: Build a Personal Website wit...



157 Personal Website - How The Outp... Video - 01:42 mins - Resources (1)



158 Your First Website Video - 08:07 mins



159 HTML Templates Video - 04:09 mins - Resources (2)



160 Navigation Menu Video - 08:32 mins - Resources (3)



161 Note on Browser Caching Article

162 CSS Styling



Lectures More



160 Video - 08:32 mins - Resources (3)

161 Note on Browser Caching Article

162 CSS Styling

Video - 05:59 mins - Resources (1)



163 Creating a Python Virtual Environ... Video - 06:22 mins



164 How to Install Git Article

165 Deploying the Website to a Live S... Video - 22:06 mins - Resources (2)



166 Maintaining the Live Website Video - 07:26 mins



167 Troubleshooting Article

168 Congratulations! Article

Report – Report can be typed or hand written for up to two pages.

Day 1 Python

26/5/2020

Application 4: Build a personal website with python and flask

Your First website

Enter the path for the new file

Script4.py

```
→ from flask import Flask
    app = Flask(__name__)
    @app.route('/')
    def home():
        return "website content goes here!"
    if __name__ == "__main__":
        app.run(debug=True)
```

Case 1 – Script Executed

__name__ = "__main__"

Case 2 – Script Imported

__name__ = "Script4"

HTML Templates

from flask import Flask, render_template,

→ return render_template("home.html")

→ return render_template("about.html")

Navigation Menu.

<doctype html>

<html>

<body>

<h1> My about page </h1>

<p> This is a test website again </p>

</body>

</html>

CSS Styling

Aditya's web app

• Home

• about

My home page

This is a website

PERMUNOTES PRO

Deploying the website to a Live Server

from flask import Flask, render_template

if __name__ == '__main__':

@app.route('/')

def home():

return render_template("home.html")

@app.route('/about')

def about():

return render_template("about.html")

if __name__ == '__main__':

app.run(debug=True)

Maintaining the Live Website

{% extends "layout.html" %}

{% block content %}

<div class="about">

<h1> My about page </h1>

<p> This is a test website again </p>

<p> This was added later </p>

</div>

D:\Dropbox\pp\l-d-flask-website-d\mysite\demo\git add
D:\Dropbox\pp\l-d-flask-website-d\mysite\demo\git commit
-m "add text to about.html"

1. change heading colour

2. file changed, 2 insertions (+), 1 deletion (-)

D:\Dropbox\pp\l-d-flask-website-d\mysite\demo

