Department of Mathematics

School of Advanced Sciences

MAT 1011 – Calculus for Engineers (MATLAB)

Experiment 2–B

Laplace transforms, Inverse Laplace transform

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Question 1(i)

Write the MATLAB code to find the Laplace transform of f(t) $f(t) = 1 + 2\sqrt{t} + \frac{3}{\sqrt{t}}$

CODES:

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given function
is')
disp(F)
```

INPUT:

```
Enter the function
1+2*sqrt(t)+3/sqrt(t)
```

OUTPUT:

The laplace transform of the given function is
1/s + (3*pi^(1/2))/s^(1/2) + pi^(1/2)/s^(3/2)

```
1  clear
2  close all
3  clc
4  syms t
5  f=input('Enter the function');
6  F=laplace(f);
7  disp('The laplace transform of the given function is')
8  disp(F)
9
```

Command Window

```
Enter the function

1+2*sqrt(t)+3/sqrt(t)

The laplace transform of the given function is
1/s + (3*pi^(1/2))/s^(1/2) + pi^(1/2)/s^(3/2)
```

Question 1(ii)

Write the MATLAB code to find the Laplace transform of f(t)

$$f(t)=\begin{cases}\sin t & ; \quad 0 \le t \le \pi \\ 0 & ; \quad \pi \le t \le 2\pi\end{cases}$$

Code :

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given function
is')
disp(F)
```

INPUT:

```
Enter the function
sin(t)*(heaviside(t)-heaviside(t-pi))+0*(heaviside(t-pi)-
heaviside(t-2*pi))
```

OUTPUT:

```
The laplace transform of the given function is
(exp(pi*s) + 1)/(exp(pi*s) + s^2*exp(pi*s))
```

```
1  clear
2  close all
3  clc
4  syms t
5  f=input('Enter the function');
6  F=laplace(f);
7  disp('The laplace transform of the given function is')
8  disp(F)
9
```

Command Window

```
Enter the function

sin(t)*(heaviside(t)-heaviside(t-pi))+0*(heaviside(t-pi)-heaviside(t-2*pi))

The laplace transform of the given function is
(exp(pi*s) + 1)/(exp(pi*s) + s^2*exp(pi*s))

>>
```

Question 1(iii):

Write the MATLAB code to find the Laplace transform of

$$f(t) = \sin^3 t$$

Codes:

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given
function is')
disp(F)
```

INPUT:

```
Enter the function
(sin(t))^3
```

OUTPUT:

```
The laplace transform of the given function is
6/((s^2 + 1)*(s^2 + 9))
```

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given function is')
disp(F)
```

Command Window

```
Enter the function
(sin(t))^3
The laplace transform of the given function is
6/((s^2 + 1)*(s^2 + 9))

>>
```

Question 1(IV):

Write the MATLAB code to find the Laplace transform of

$$f(x) = sin(2t).sin(3t)$$

Codes:

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);exp()
disp('The laplace transform of the sin(2t)given
function is')
disp(F)
```

INPUT:

```
Enter the function
sin(2*t)*sin(3*t)
```

OUTPUT:

The laplace transform of the given function is

```
s/(2*(s^2 + 1)) - s/(2*(s^2 + 25))
```

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given function is')
disp(F)
```

Command Window

```
Enter the function

sin(2*t)*sin(3*t)

The laplace transform of the sin(2t)given function is
s/(2*(s^2 + 1)) - s/(2*(s^2 + 25))


>>
```

Question 1(v):

Write the MATLAB code to find the Laplace transform of

$$f(t) = e^{-t}sin^2t$$

Codes:

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given function
is')
disp(F)
```

Input:

```
Enter the function
exp(-t)*(sin(t))^2
```

Output:

```
The laplace transform of the given function is
1/(2*(s + 1)) - (s + 1)/(2*((s + 1)^2 + 4))
```

```
1  clear
2  close all
3  clc
4  syms t
5  f=input('Enter the function');
6  F=laplace(f);exp()
7  disp('The laplace transform of the given function is')
8  disp(F)
9
```

Command Window

```
Enter the function
exp(-t)*(sin(t))^2
The laplace transform of the given function is
1/(2*(s + 1)) - (s + 1)/(2*((s + 1)^2 + 4))

>>
```

Question 1 (vi):

Write the MATLAB code to find the Laplace transform of

$$f(t) = \frac{cos(2t) - cos(3t)}{t}$$

Codes:

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given
function is')
disp(F)
```

INPUT:

```
Enter the function
(cos(2*t)-cos(3*t))/t
```

OUTPUT:

```
The Laplace transform of the given function is
log(9/s^2 + 1)/2 - log(4/s^2 + 1)/2
```

```
clear
close all
clc
syms t
f=input('Enter the function');
F=laplace(f);
disp('The laplace transform of the given function is')
disp(F)
```

Command Window

```
Enter the function
(cos(2*t)-cos(3*t))/t
The laplace transform of the given function is
log(9/s^2 + 1)/2 - log(4/s^2 + 1)/2

>>
```

Question number 2(i)

Find the inverse Laplace transforms of the following functions: $\boldsymbol{f(x) = \frac{6}{s^2+2s-8}}$

CODE:

```
clear
close all
clc
syms s a
F=input('Enter the function of s to calculate
its laplace inverse:');
f=ilaplace(F);

disp('The inverse laplace of the given function
is :')
disp(f);
```

INPUT:

```
Enter the function of s to calculate its laplace
inverse:
6/(s^2+2*s-8)
```

OUTPUT:

```
The inverse laplace of the given function is :
exp(2*t) - exp(-4*t)
```

```
clear
close all
clc
syms s a
F=input('Enter the function of s to calculate its laplace inverse:');
f=ilaplace(F);

disp('The inverse laplace of the given function is :')
disp(f);


```

Command Window

```
Enter the function of s to calculate its laplace inverse:

6/(s^2+2*s-8)

The inverse laplace of the given function is :
exp(2*t) - exp(-4*t)
```

Question number 2(ii)

Find the inverse Laplace transforms of the following functions: $\boldsymbol{f(x) = \frac{4s+5}{(s-1)^2(s+2)}}$

Codes:

```
clear
close all
clc
syms s a
F=input('Enter the function of s to calculate
its laplace inverse:');
f=ilaplace(F);

disp('The inverse laplace of the given function
is :')
disp(f);
```

INPUT:

```
Enter the function of s to calculate its laplace
inverse:
 (4*s+5)/(((s-1)^2)*(s+2))
```

OUTPUT:

The inverse laplace of the given function is :
exp(t)/3 - exp(-2*t)/3 + 3*t*exp(t)

```
1   clear
2   close all
3   clc
4   syms s a
5   F=input('Enter the function of s to calculate its laplace inverse:');
6   f=ilaplace(F);
7
8   disp('The inverse laplace of the given function is :')
9   disp(f);
10
11
12
```

Command Window

```
Enter the function of s to calculate its laplace inverse:
 (4*s+5)/(((s-1)^2)*(s+2))

The inverse laplace of the given function is :
exp(t)/3 - exp(-2*t)/3 + 3*t*exp(t)
```

Question number 2(ii)

Find the inverse Laplace transforms of the following functions

$$F(s) = \frac{s^2 + 2s - 4}{(s^2 + 2s + 5)(s^2 + 2s + 2)}$$

CODES:

```
clear
close all
clc
syms s a
F=input('Enter the function of s to calculate its laplace inverse:');
f=ilaplace(F);

disp('The inverse laplace of the given function is :')
disp(f);
```

INPUT:

```
Enter the function of s to calculate its laplace inverse:
(s^2+2*s-4)/((s^2+2*s+5)*(s^2+2*s+2))
```

OUTPUT:

The inverse laplace of the given function is :
(3*sin(2*t)*exp(-t))/2 - 2*exp(-t)*sin(t)

```
1   clear
2   close all
3   clc
4   syms s a
5   F=input('Enter the function of s to calculate its laplace inverse:');
6   f=ilaplace(F);
7
8   disp('The inverse laplace of the given function is :')
9   disp(f);
10
11
12
```

Command Window

```
Enter the function of s to calculate its laplace inverse:
(s^2+2*s-4)/((s^2+2*s+5)*(s^2+2*s+2))
The inverse laplace of the given function is :
(3*sin(2*t)*exp(-t))/2 - 2*exp(-t)*sin(t)
```

THANK YOU