Faculty Of Engineering and Technology

Electrical And Computer Engineering Department

Signals & Systems

ENEE 2302

MATLAB Assignment

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❖ Question 1

➢ Generate and plot the following signals using MATLAP :

1- $X1(t) = u(t-2) - u(t-9)$

2- $Pi(t)\ with\ value\ 8\ and\ extension\ fron\ 6\ to\ 14$

3- $X2(t) = u(t-4) + r(t-4) - 2r(t-7) + r(t-13)\ in\ t\ interval [0\ 16]$

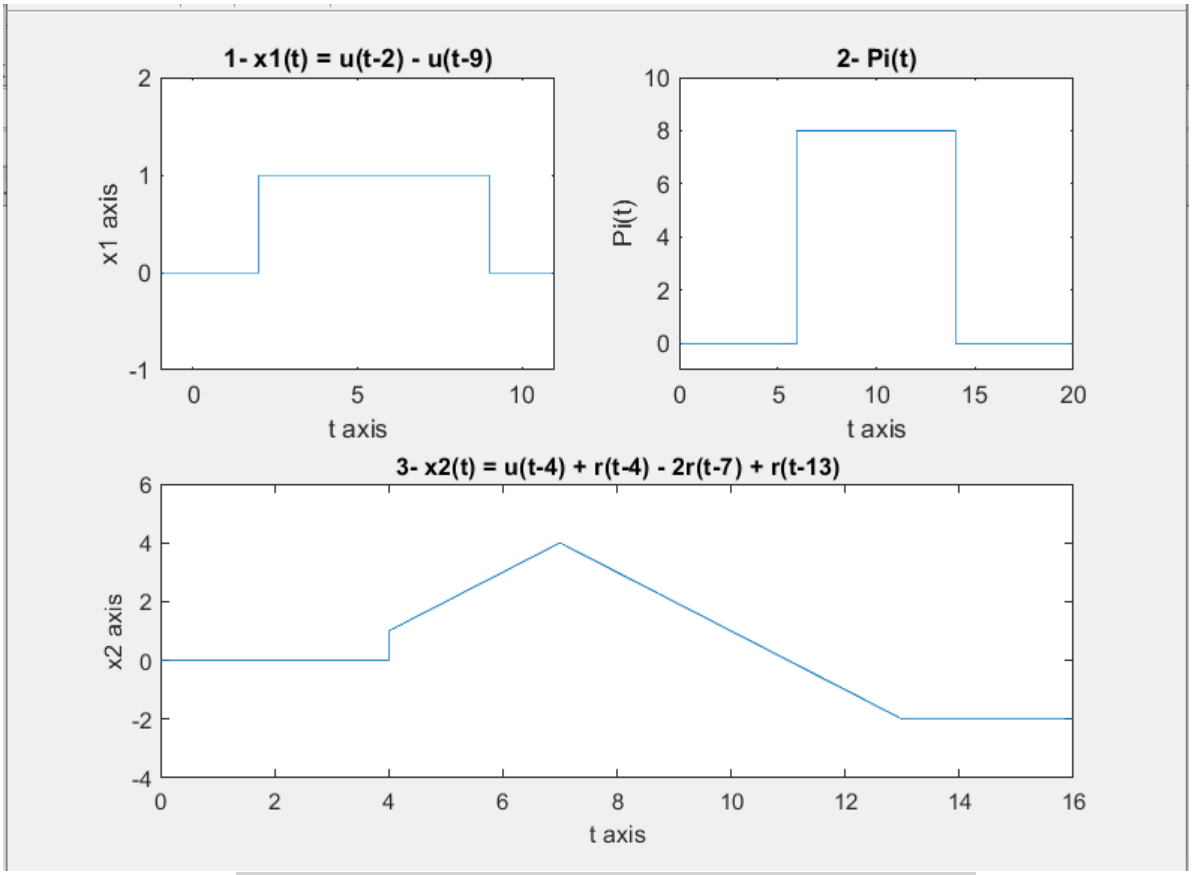


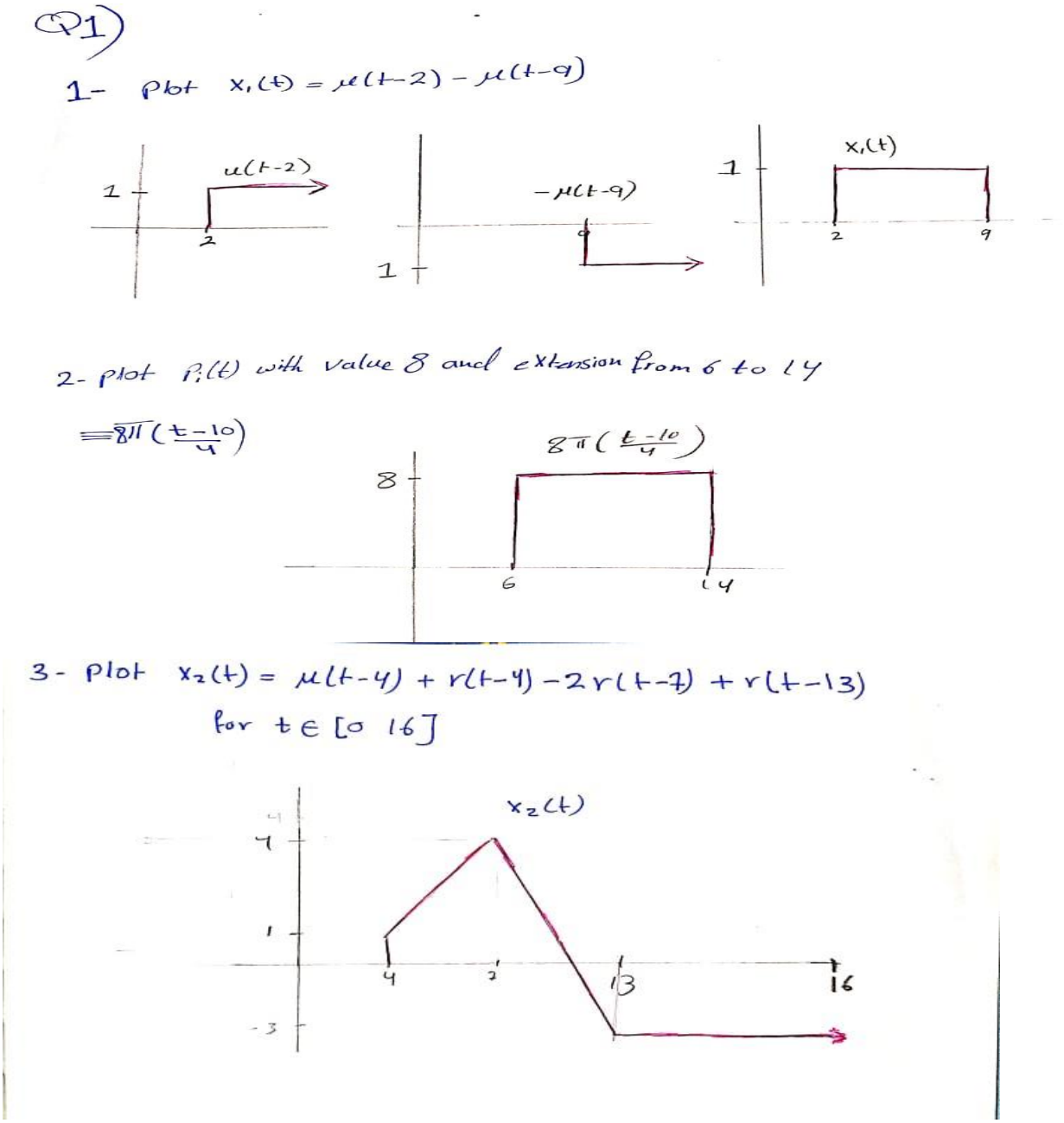
Fig 1.1 (plot of the above three signals X1(t) , Pi(t) , and X2(T))

Discussion :

- Plot 1: u(t) = 1 : t>2 , 0 otherwise , and u(t-9) = 1 : t>9 , 0 otherwise , so u(t-2)- u(t-9) will be 1 :t € [2,9] , 0 otherwise , and this identically for the generated plot (plot 1) , which mean the plot is correct.
- Plot 2: Pi(t) with value = 8 and extension from 6 to 14 , means that the signal have a magnitude=8 in the interval [6 14] , and 0 otherwise , and this

is identical to the generated signal in (plot 2) , which means the code used to plot this signal is correct .

- Plot 3: By analyzing the signal X2(t) we notes that it was the same as the generated signal in (plot 3) , which means the code used to describe and plot this signal is correct .



The solution of the first question and it's identical to the generated plots using MATLAB

❖ Question 2

- Write a program that computes and plots the convolution of the functions
  - $X(t) = (10\ e^{-0.5t}) * Pi(\frac{t-7}{4})$
  - $Y(t) = (10\ te^{-0.5t}) * Pi\left(\frac{t-12}{8}\right)$

The Computed result from the command window is :

con_ans =

50*heaviside(t - 21)*exp(-t/2)*(- t^2 + 10*t + 231) - 50*heaviside(t - 25)*exp(-t/2)*(- t^2 + 18*t + 175) - 50*heaviside(t - 13)*exp(-t/2)*(- t^2 + 10*t + 39) - 50*heaviside(t - 17)*exp(-t/2)*(t^2 - 18*t + 17)

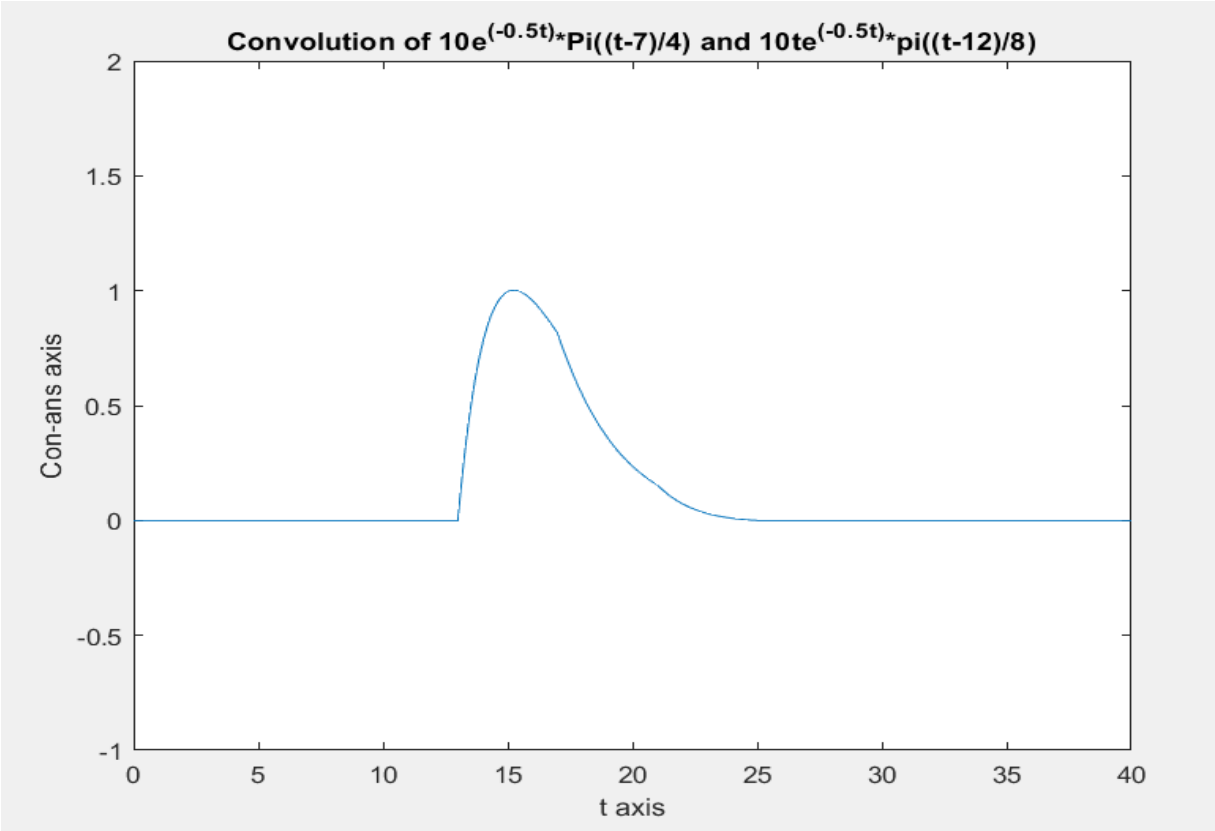


Fig 2.1 plot of the convolution of the two functions .

Discussion :

The result of the generated plot was as expected to be when calculating it manually.

❖ Question 3

- Generate and plot the following signals :

  1- $y1(t) = \sin(300 * pi * t)$

  2- $y2(t) = \cos(800 * pi * t)$

  3- $m(t) = \mathrm{y1(t)} + y2(t)$

  4- $n(t) = \mathrm{y1(t)} - \mathrm{y2(t)}$

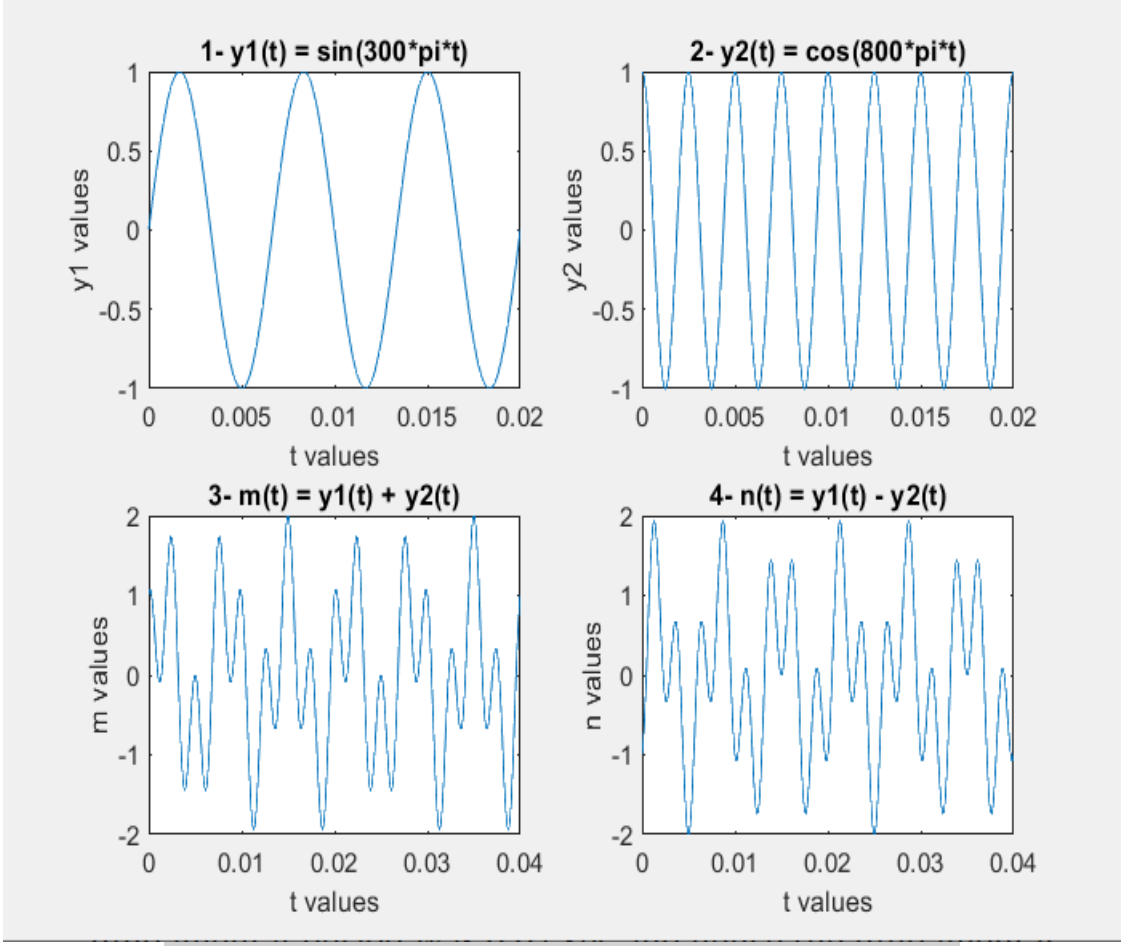


Fig 3.1 (Plot of the above four signals y1(t) , y2(t) , m(t) , and n(t)) .

Discussion :

- Plot1 : plot 1 was as expected to be (it's simply the sin function) , such that I have take 3 period of this signals since the largest value for t was 3/150 .
- Plot2 : plot 2 was as expected to be (it's simply the cosine function) , such that I have taken 8 period of this signal since the largest chosen value for t was 3/150 .

- Plot3 : plot 3 also was as expected to be .
- Plot4 : Plot 4 was as expected to be .

➢ Determine , using the MATLAB plots , if the generated signals are periodic and if a signal is periodic then determine it's fundamental frequency .

By looking into Fig3.1 it can be seen easily that the four generated signals are periodic , such that the fundamental frequency for every signal is :

1- $y1(t) = \sin(300 * pi * t)$ ➔ omega1 = 300*pi ➔ f0 = f1 = (300*pi)/(2*pi) =150Hz.
2- $y2(t) = \cos(800 * pi * t)$ ➔ omega2 = 800*pi ➔ f0 = f2 = (800*pi)/(2*pi) =400Hz .
3- $m(t) = \mathrm{y1(t)} + y2(t)\ and\ n(t) = y1(t) - y2(t)$ ➔ f0 = GCD(f1,f2) = 50 Hz , the same as the one noticed from the plots such that the fundamental period was 0.02 sec and hence the fundamental frequency is $1/0.02 = 50$Hz (f0 = 1/t0) .

❖ Appendix A

➢ Program For Question 1

```
% Question 1
syms t x1 Pi x2;

%first signal
x1 = heaviside(t-2) - heaviside(t-9);
subplot(2,2,1);
fplot(x1);
xlabel('t axis');
ylabel('x1 axis');
title('1- x1(t) = u(t-2) - u(t-9)');
axis([-1 11 -1 2]);

%second signal
Pi = 8.*rectangularPulse(6,14,t);
subplot(2,2,2);
fplot(Pi);
xlabel('t axis');
ylabel('Pi(t)');
title('2- Pi(t)');
axis([0 20 -1 10]);

% third signal
x2 = heaviside(t-4) + (t-4)*heaviside(t-4) - 2.*(t-7)*heaviside(t-7) + (t-13)*heaviside(t-13);
subplot(2,2,[3 4]);
fplot(x2);
axis([0 16 -4 6]);
xlabel('t axis');
ylabel('x2 axis');
title('3- x2(t) = u(t-4) + r(t-4) - 2r(t-7) + r(t-13)');
```

Fig 1.2 (Program for Q1)

➢ Program for Question 2

```
1
2   % Question 2
3
4   syms t toe x y con_ans ;
5
6   x = 10 * exp( -0.5 *toe ) * rectangularPulse(5,9,toe);
7
8   y = 10 * (t-toe) * exp( -0.5 * (t-toe) ) * rectangularPulse(8,16,t-toe) ;
9
10  con_ans = int(x*y,toe,-inf,inf)
11
12  fplot(con_ans);
13  xlabel('t axis');
14  ylabel('Con-ans axis');
15  title('Convolution of 10e^(^-^0^.^5^t^)*Pi((t-7)/4) and 10te^(^-^0^.^5^t^)*pi((t-12)/8)');
16  axis([0 40 -1 2]);
17
```

Fig 2.2 (program for Q2) .

➢ Program for Question 3

```
% Question 3 program
syms t y1 y2 m n ;

%first signal
y1 = sin(300*pi*t) ;
subplot(2,2,1);
fplot(y1);
xlabel('t values');
ylabel('y1 values');
title('1- y1(t) = sin(300*pi*t)');
axis([0 (3/150) -1 1]);

%second signal
y2 = cos(800*pi*t);
subplot(2,2,2);
fplot(y2);
xlabel('t values');
ylabel('y2 values');
title('2- y2(t) = cos(800*pi*t)');
axis([0 (3/150) -1 1]);

%third signal
m = y1 + y2 ;
subplot(2,2,3);
fplot(m);
xlabel('t values');
ylabel('m values');
title('3- m(t) = y1(t) + y2(t)');
axis([0 (6/150) -2 2]);  % the range for the horizontal and vertical axis

%fourth signal
n = y1 - y2  ;
subplot(2,2,4);  % to put the figure in the right-down corner
fplot(n);
xlabel('t values');
ylabel('n values');
title('4- n(t) = y1(t) - y2(t)');
axis([0 (6/150) -2 2]);  % the range for the horizontal and vertical axis
```

Fig 3.2 (program for Q3) .