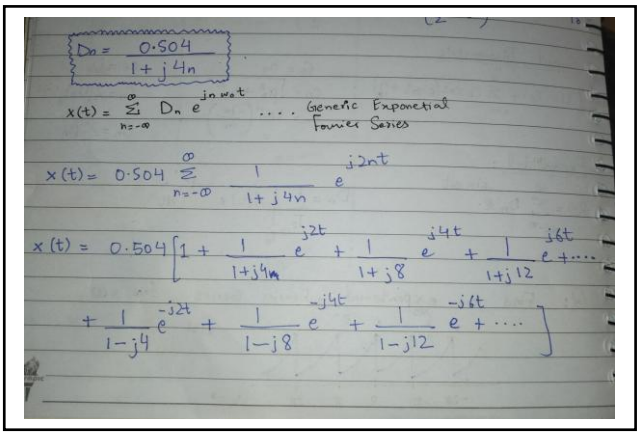
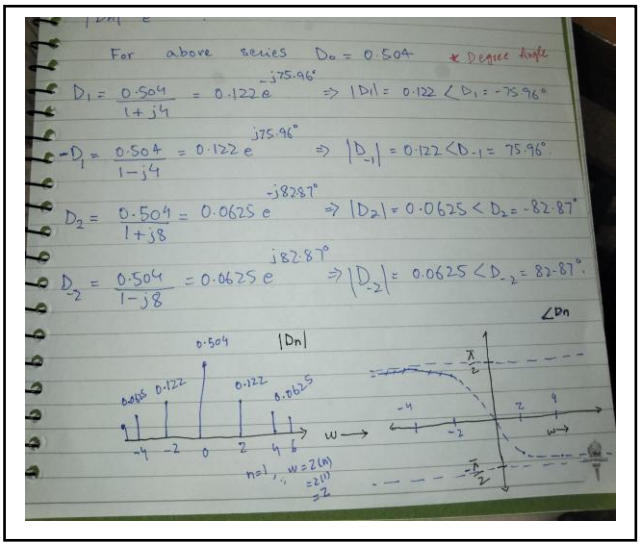
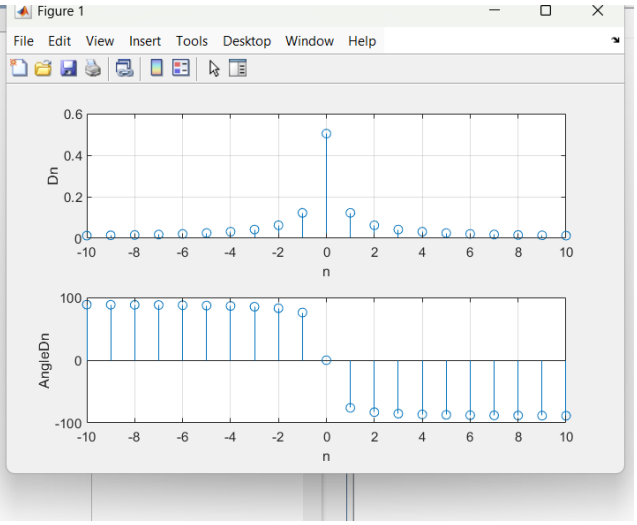
# Lab 9

## Exercise 9.1

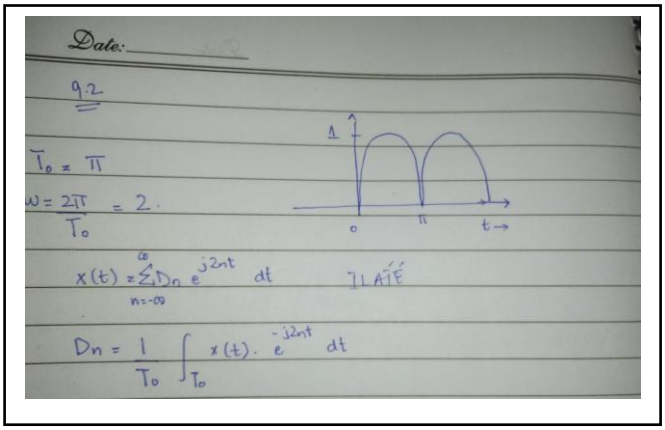


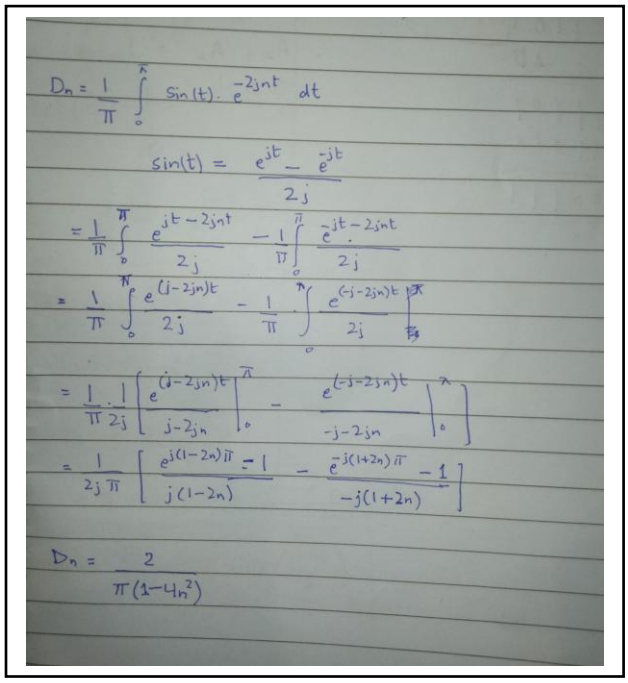



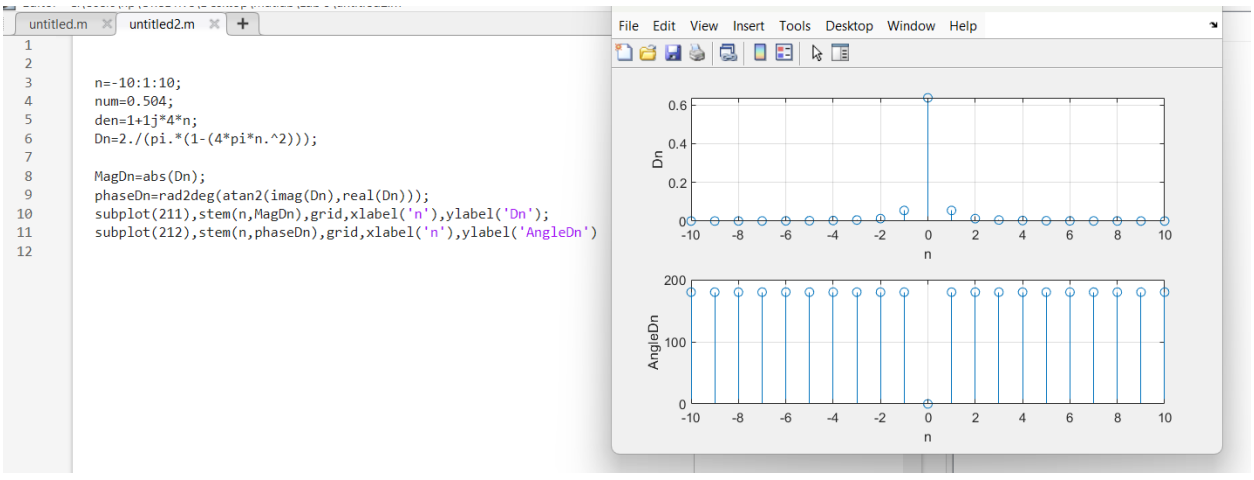

```
untitled.m
1
2
3
4   n=-10:1:10;
5   num=0.504;
6   den=1+1j*4*n;
7   Dn=num./den;
8   MagDn=abs(Dn);
9
10  phaseDn=rad2deg(atan2(imag(Dn),real(Dn)));
11  subplot(211),stem(n,MagDn),grid,xlabel('n'),ylabel('Dn');
12  subplot(212),stem(n,phaseDn),grid,xlabel('n'),ylabel('AngleDn')
13
```



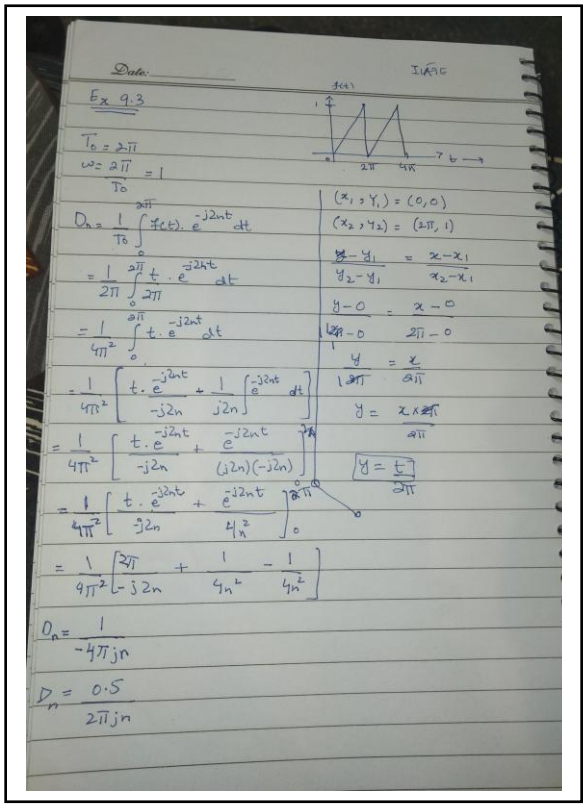
## Exercise 9.2


Date:
9.2
$T_0 = \pi$
$\omega = \frac{2\pi}{T_0} = 2$
$x(t) = \sum_{n=-\infty}^{\infty} D_n e^{j2nt}$ dt
ILAIE
$D_n = \frac{1}{T_0} \int_{T_0} x(t) \cdot e^{-j2nt}$ dt


$D_n = \frac{1}{\pi} \int_0^{\pi} \sin(t) \cdot e^{-2jnt}$ dt
$\sin(t) = \frac{e^{jt} - e^{-jt}}{2j}$
$= \frac{1}{\pi} \int_0^{\pi} \frac{e^{jt-2jnt}}{2j} - \frac{1}{\pi} \int_0^{\pi} \frac{e^{-jt-2jnt}}{2j}$
$= \frac{1}{\pi} \int_0^{\pi} \frac{e^{(j-2jn)t}}{2j} - \frac{1}{\pi} \int_0^{\pi} \frac{e^{(-j-2jn)t}}{2j}$
$= \frac{1}{\pi} \cdot \frac{1}{2j} \left[ \frac{e^{(j-2jn)t}}{j-2jn} \Big|_0^{\pi} - \frac{e^{(-j-2jn)t}}{-j-2jn} \Big|_0^{\pi} \right]$
$= \frac{1}{2j\pi} \left[ \frac{e^{j(1-2n)\pi} - 1}{j(1-2n)} - \frac{e^{-j(1+2n)\pi} - 1}{-j(1+2n)} \right]$
$D_n = \frac{2}{\pi(1-4n^2)}$


untitled.m
untitled2.m
1
2
3 n=-10:1:10;
4 num=0.504;
5 den=1+1j*4*n;
6 Dn=2./(pi.*(1-(4*pi*n.^2)));
7
8 MagDn=abs(Dn);
9 phaseDn=rad2deg(atan2(imag(Dn),real(Dn)));
10 subplot(211),stem(n,MagDn),grid,xlabel('n'),ylabel('Dn');
11 subplot(212),stem(n,phaseDn),grid,xlabel('n'),ylabel('AngleDn')
12
File Edit View Insert Tools Desktop Window Help
Dn
0.6
0.4
0.2
0
-10 -8 -6 -4 -2 0 2 4 6 8 10
n
AngleDn
200
100
0
-10 -8 -6 -4 -2 0 2 4 6 8 10
n

## Exercise 9.3




untitled.m | untitled2.m

```
1
2   D0=0.5;
3   num=1j;
4   n=-10:1:10;
5   num=0.504;
6   den=2*pi*n;
7   Dn=num./den;
8
9   Dn(ceil(length(Dn)/2))=D0;
10  MagDn=abs(Dn);
11
12  phaseDn=rad2deg(atan2(imag(Dn),real(Dn)));
13  subplot(211),stem(n,MagDn),grid,xlabel('n'),ylabel('Dn');
14  subplot(212),stem(n,phaseDn),grid,xlabel('n'),ylabel('AngleDn')
15
```