Cosmos College of Management and Technology

Subject: Principle of Communications

Lab-2

Objective:

- To generate deterministic and random signals

1. Deterministic Signals

1.1 Sampling and Plotting Sinusoids

1. Determine the amplitude, phase, period, sampling frequency, circular frequency (Hz) and angular frequency (rad/sec) of sine wave.

Ans:

$x(t) = 20\cos(2\pi(40)t-0.4\pi)$…….i

Comparing equation i with $x(t) = A\cos(2\pi ft-\Phi)$, we get

Amplitude (A) = 20

Phase (Φ) = 0.4π

Period (T) = 1/f = 1/40 = 0.025 sec

Sampling Frequency (Fs) = 2f =2 ×40 = 80 Hz

Circular Frequency (f) = 40 Hz

Angular Frequency (w) = $2\pi f$ =251.327 rad/sec

2. Plot the sinusoidal signal with different values of sampling periods

Program Code:

```
% the sinusoidal signal with different values of sampling periods
clear all;
close all;
n=linspace(0,1,1000);
f=30;
x=sin(2*pi*f*n);
subplot(3,1,1);
plot(n,x);
ylabel('Amplitude');
```

```
title('sinewave with period 0.033 sec');
subplot(3,1,2);
f=20;
x=sin(2*pi*f*n);
plot(n,x,'g');
ylabel('Amplitude');
title('sinewave with period 0.05 sec');
subplot(3,1,3);
f=10;
x=sin(2*pi*f*n);
plot(n,x,'r');
xlabel('Time');
ylabel('Amplitude');
title('sinewave with period 0.1 sec');
```

3. Generate a sine wave of frequency 60 Hz, sample it and then quantize it. Also, study the behavior of aliasing due to under sampling.

Program Code:

```
%Generate a sine wave of frequency 60 Hz, sample it and then quantize it.
clear all
close all
n=linspace(0,1,60);
f=60;
x=5*sin(2*pi*f*n);
subplot(4,1,1);
plot(n,x);
xlabel('Time');
ylabel('Amplitude');
title('Sine Wave');
grid;
```

```
subplot(4,1,2);
stem(n,n>=0);
xlabel('Time');
ylabel('Amplitude');
title('Imulse trains');
grid;
 subplot(4,1,3);
stem(n,x);
xlabel('Time');
ylabel('Amplitude');
title('Sampled Signal');
grid;
 x=round(x);
subplot(4,1,4);
stem(n,x);
xlabel('Time');
ylabel('Amplitude');
title('Quantised Signal');
grid;
```

Program Code:

```
%Study the behavior of aliasing due to under sampling
clear all
close all
n=linspace(0,1,8);
f=8;
x=5*sin(2*pi*f*n);
plot(n,x);
xlabel('Time');
ylabel('Amplitude');
title('Effect of under sampling');
```

```
grid;
```

2. Random Signals

1. Write a program that generates a normally distributed random signal of length 100 samples.

Program Code:

```
%Write a program that generates a normally distributed random signal of length 100 samples.
clear all;
close all;
t=linspace(0,1,100);
y=randn(1,100);
plot(t,y,t,y,'o');
xlabel('Time');
ylabel('Amplitude');
title('Normally distributed random signal');
```

2. Write a program to generate noisy sinusoidal wave.

Program Code:

```
%Write a program to generate noisy sinusoidal wave.
clear all;
close all;
t=linspace(0,1,100);
noisey=randn(1,100);
f=1;
A=10;
siny=A*sin(2*pi*f*t);
noisysine=siny+noisey;
plot(t,noisysine);
xlabel('Time');
ylabel('Amplitude');
title('Noisy Sinusoidal Wave');
```