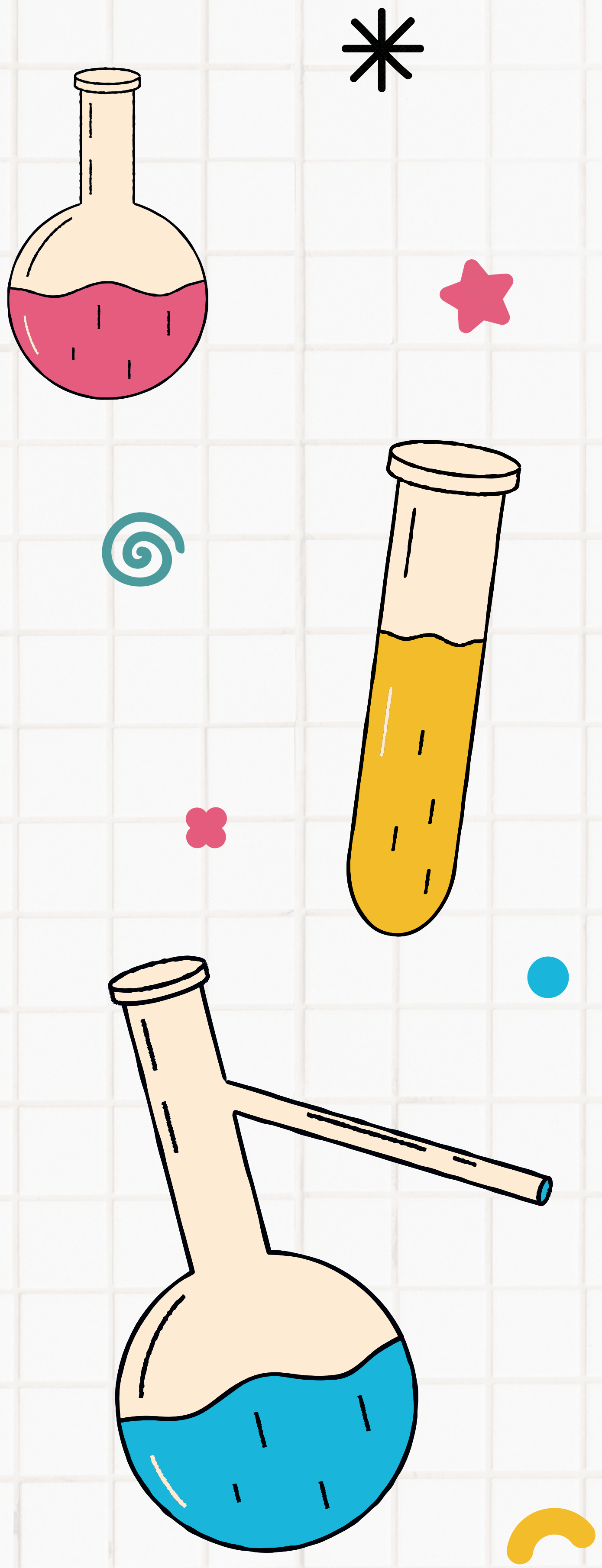
IMPLEMENTATION OF COMPOSITE AND SIMPLE WAVE WITH ATTENUATION, DISTORTION AND NOISE

DIGITAL COMMUNICATION(2CS304)

SIMPLE & COMPOSITE WAVE

- The most basic type of periodic analogue signal is the sine wave.
- Its change over the course of a cycle is smooth and steady, a continuous, rolling flow, when we represent it as a straightforward oscillating curve.
- A single arc above the time axis and a single arc below it make up each cycle.
- The peak amplitude, frequency, and phase are the three variables that can be used to describe a sine wave. A sine wave can be described entirely by these three factors.

- A composite signal is made up of two or more sine waves with distinct amplitudes, phases, and frequencies.
- When a composite signal is decomposed into its component parts, discrete signals are produced if the signal is periodic; continuous sine waves are produced when the signal is non-periodic.
- A composite signal, which is made up of numerous simple sine waves, is used instead of a simple sine wave for data exchange.
- Any composite signal, according to French mathematician Jean Baptist, is a combination of straightforward sine waves with various amplitudes, frequencies, and phases



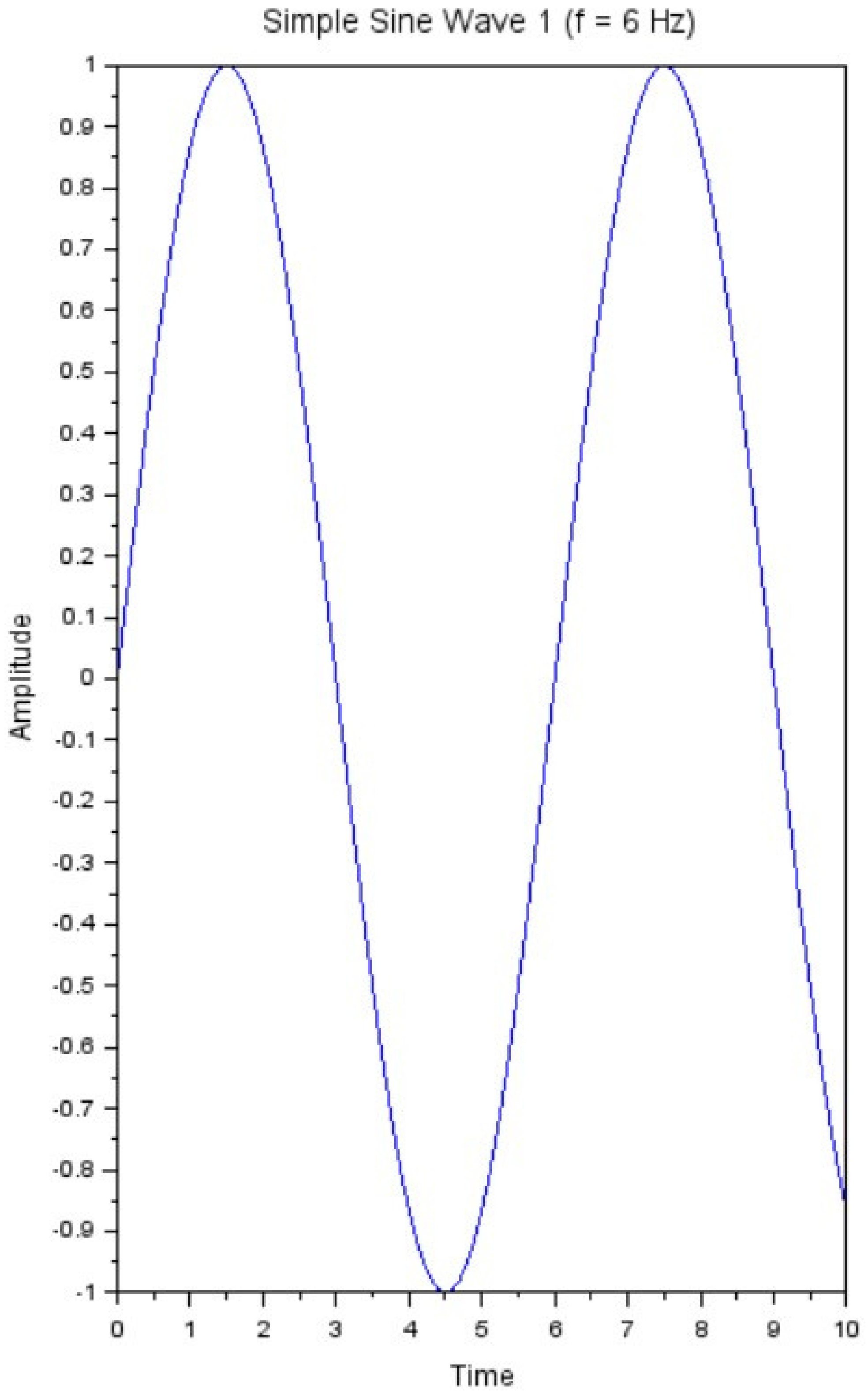
*simple sine wave.sce | composite sine wave.sce | attenuation.sce | distortion.sce | noise.sce

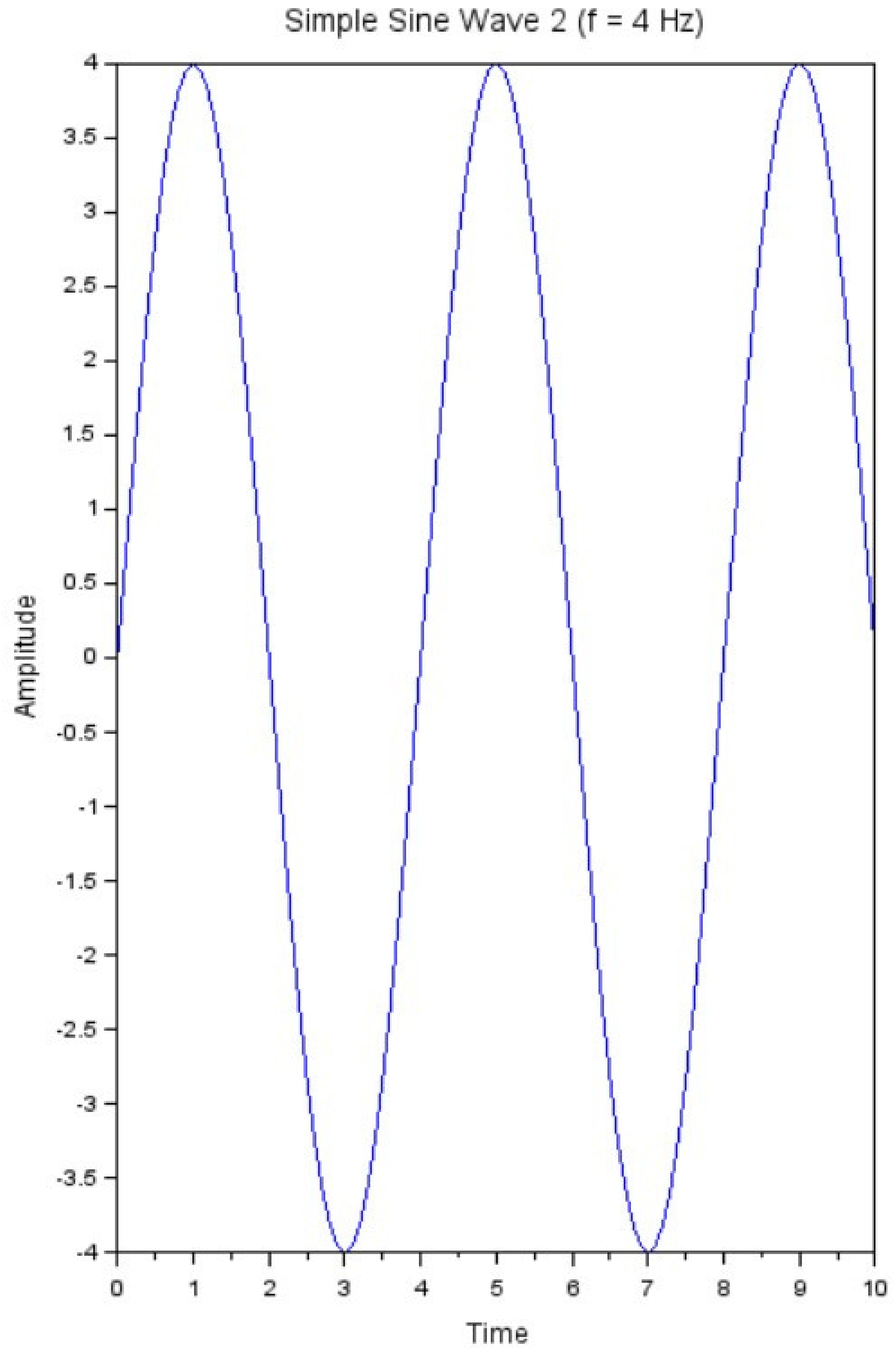
```
clc; //clear console
clear; //clear all variables
clf; //clear plot

t=0:0.1:10; //time domain 0 to 10 and step size of 0.1

// Sine Wave 1
v1 = sin (2* %pi * t /6) ;
subplot (1 ,3 ,1) ; // ploting 1 x 3 graphs currently 1st one
plot (t , v1 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Simple Sine Wave 1 (f = 6 Hz)'); //f=2*%pi/w

// Sine Wave 2
v2 = 4 * sin (2* %pi * t /4) ;
subplot (1 ,3 ,2) ;
plot (t , v2 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Simple Sine Wave 2 (f = 4 Hz) ');

// Sine Wave 3
v3 = 5 * sin (2* %pi * t/2 ) ;
subplot (1 ,3 ,3) ;
plot (t , v3 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Simple Sine Wave 3 (f = 2 Hz) ');
```

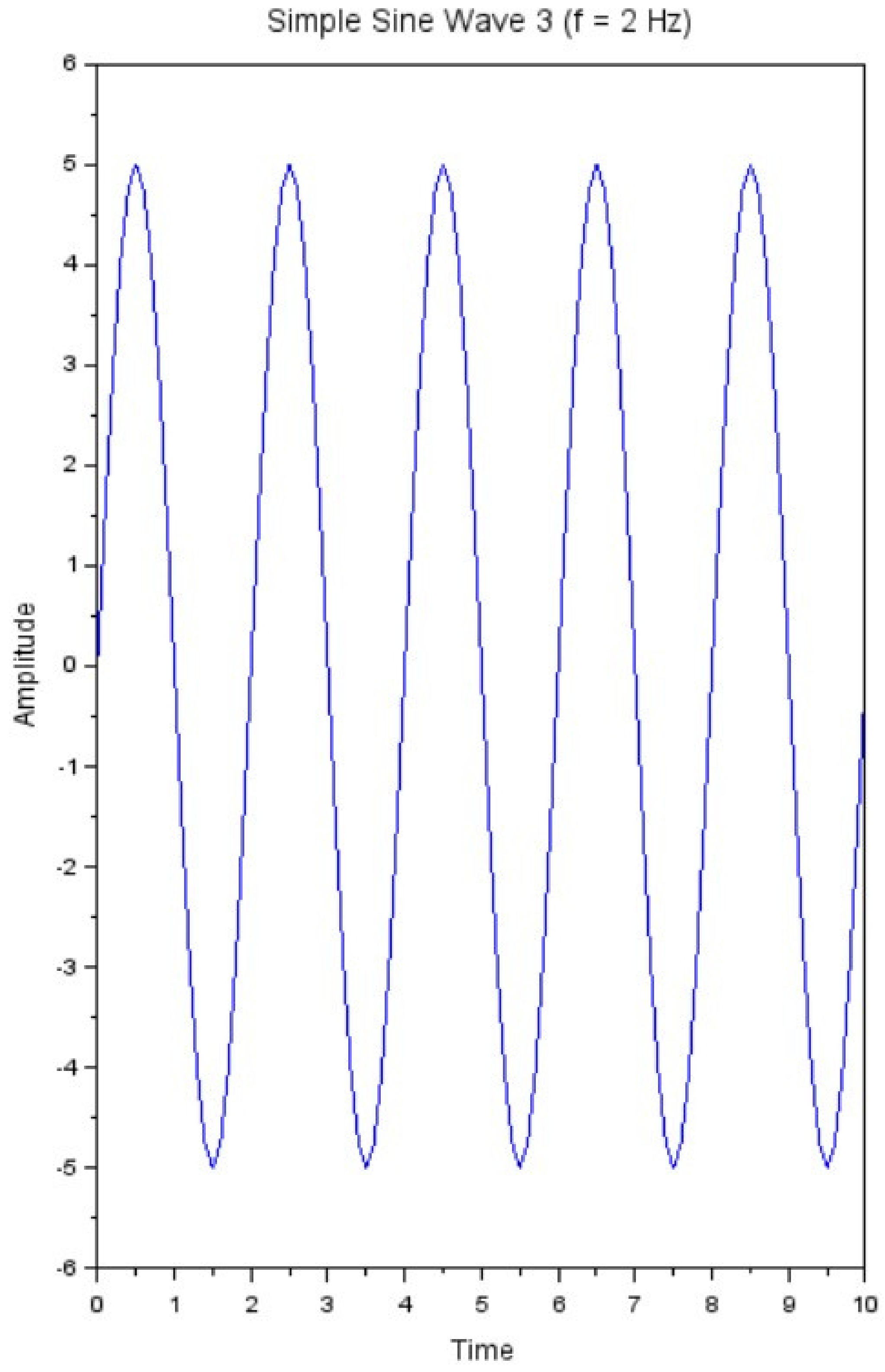
composite sine wave.sce (C:\Users\janam\Desktop\DC Innovative\composite sine wave.sce) - SciNotes

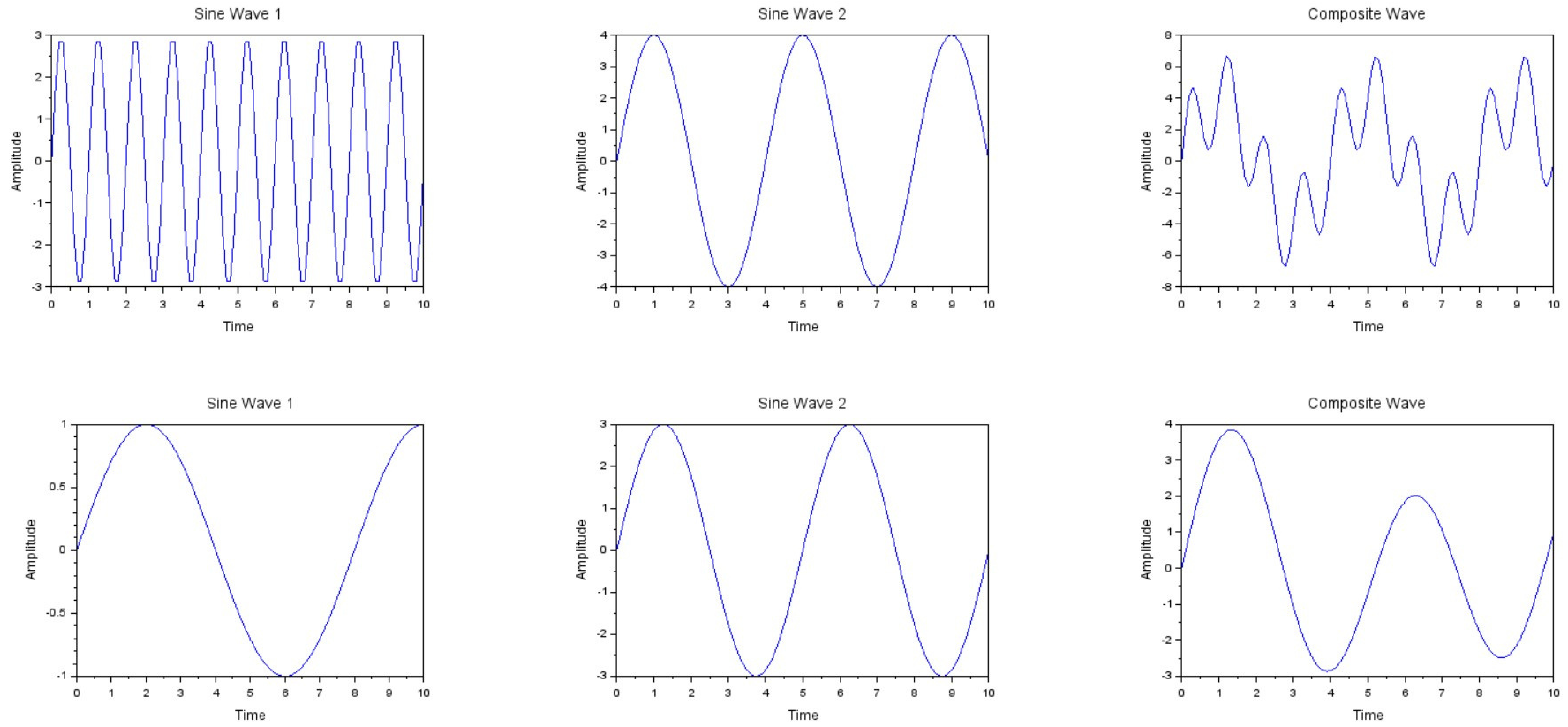
simple sine wave.sce | composite sine wave.sce | attenuation.sce | distortion.sce | noise.sce

```
t=0:0.1:10; //time domain 0 to 10 and step size of 0.1

// Composite Sine Wave 1
v1 =3*sin (2* %pi * t /1) ;
v2 =4* sin (2* %pi * t /4) ;
v3 = v1 + v2 ;

subplot (2 ,3 ,1) ;
plot (t , v1 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Sine Wave 1');

subplot (2 ,3 ,2) ;
plot (t , v2 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Sine Wave 2');

subplot (2 ,3 ,3) ;
plot (t , v3 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Composite Wave');

// Composite Sine Wave 2
v4 =1 * sin (2* %pi * t /8) ;
v5 =3 * sin (2* %pi * t /5) ;
v6 = v4 + v5 ;

subplot (2 ,3 ,4) ;
plot (t , v4 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Sine Wave 1');

subplot (2 ,3 ,5) ;
plot (t , v5 ) ;
xlabel('Time');
```

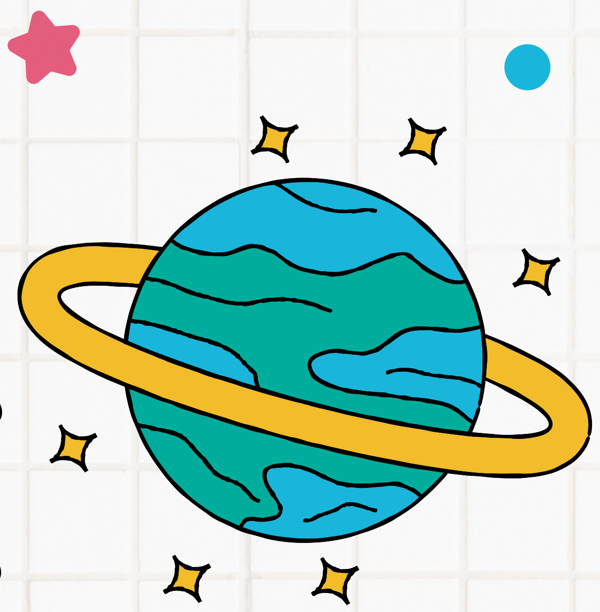

Simple Sine Wave 1 (f = 6 Hz)
Amplitude
1 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0 -0.1 -0.2 -0.3 -0.4 -0.5 -0.6 -0.7 -0.8 -0.9 -1
0 1 2 3 4 5 6 7 8 9 10
Time


Simple Sine Wave 2 (f = 4 Hz)
Amplitude
4 3.5 3 2.5 2 1.5 1 0.5 0 -0.5 -1 -1.5 -2 -2.5 -3 -3.5 -4
0 1 2 3 4 5 6 7 8 9 10
Time

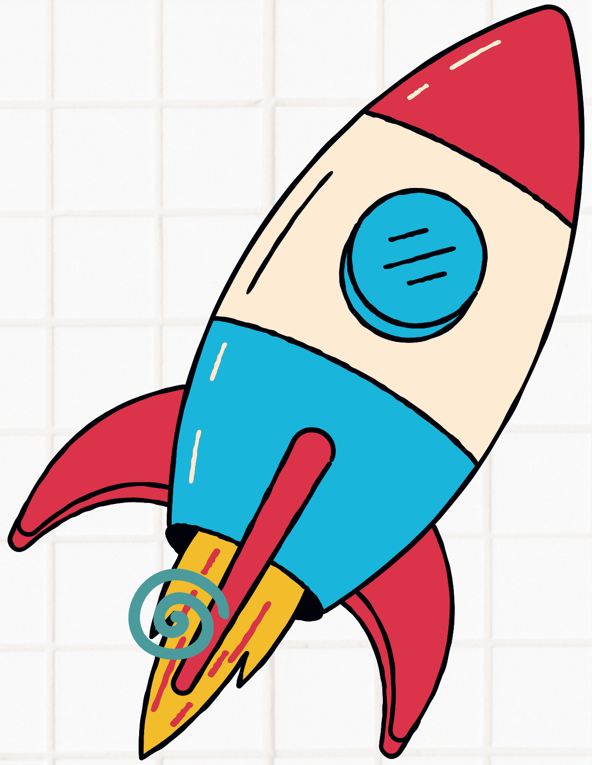

Simple Sine Wave 3 (f = 2 Hz)
Amplitude
6 5 4 3 2 1 0 -1 -2 -3 -4 -5 -6
0 1 2 3 4 5 6 7 8 9 10
Time


Sine Wave 1
Sine Wave 2
Composite Wave
Amplitude
Time
Sine Wave 1
Sine Wave 2
Composite Wave
Amplitude
Time

ATTENUATION



- Loss of energy
- When a signal, simple or composite, travels through a medium, it loses some of its energy in overcoming the resistance of the medium. That is why a wire carrying electric signals gets warm, if not hot, after awhile.
- Hence, amplifiers are used to amplify the signal



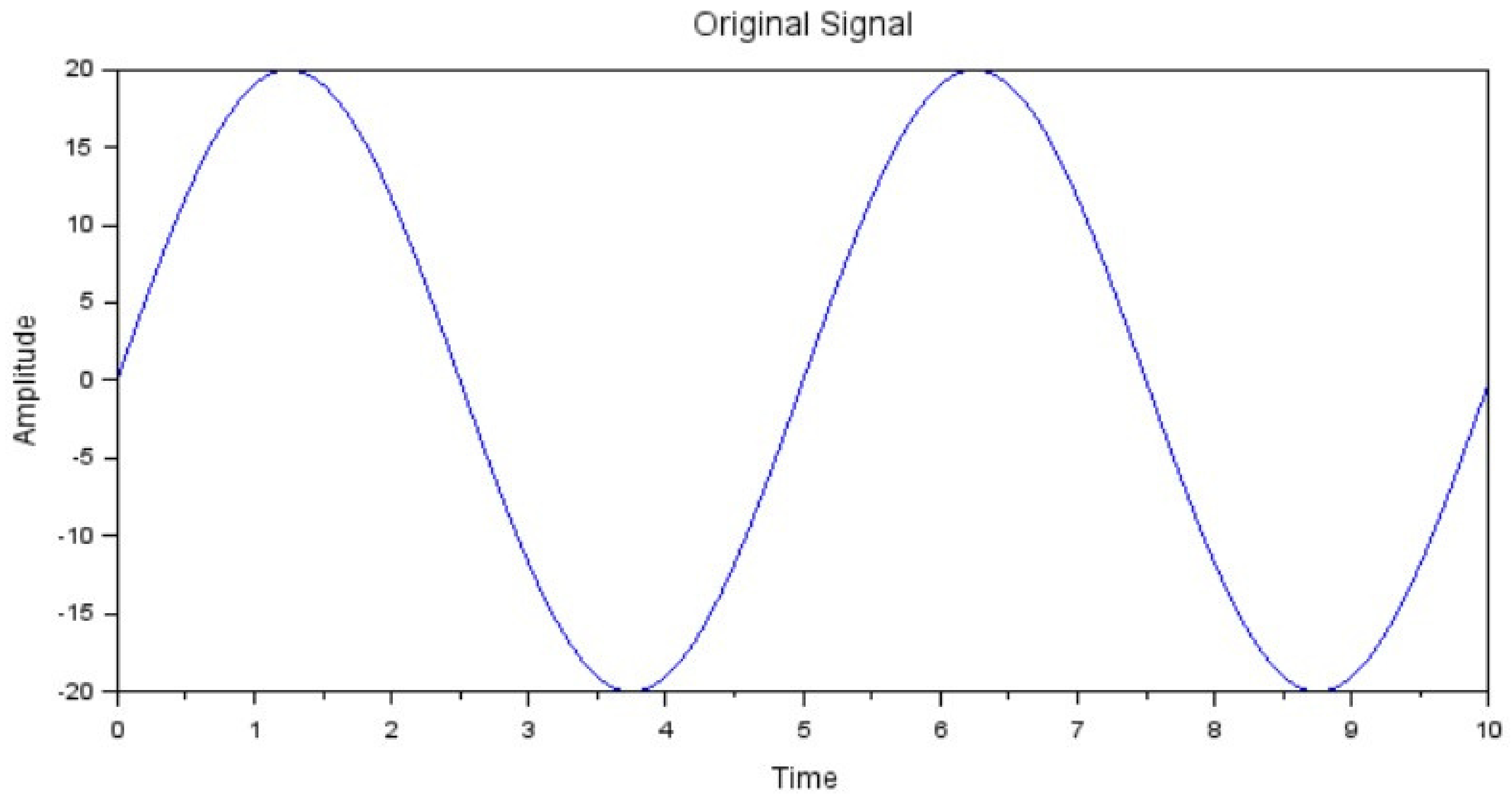
Attenuator:

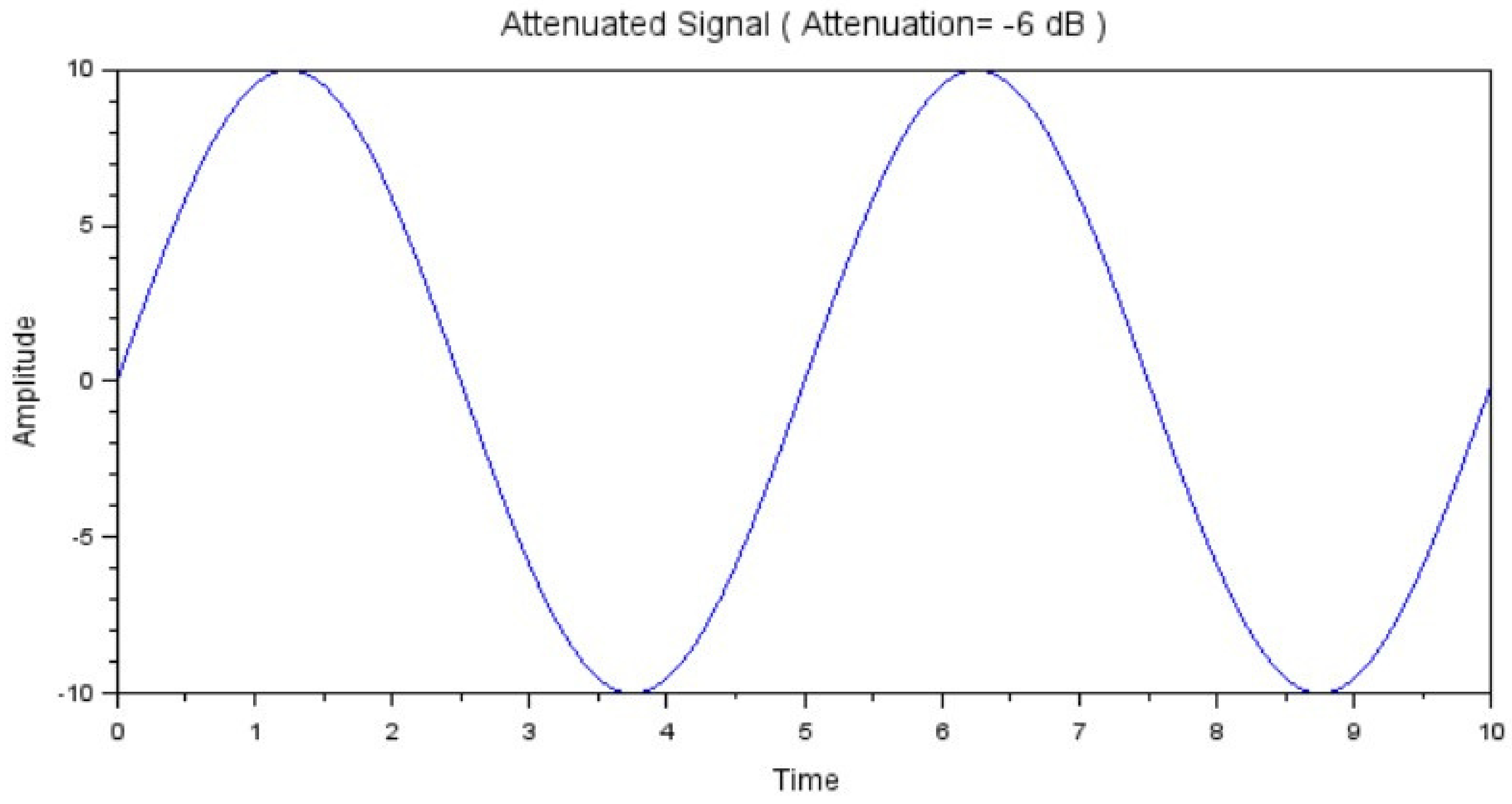
- Passive device
- Takes in high power input and provide low power output
- L-Type, T-type and Π-Type Attenuator

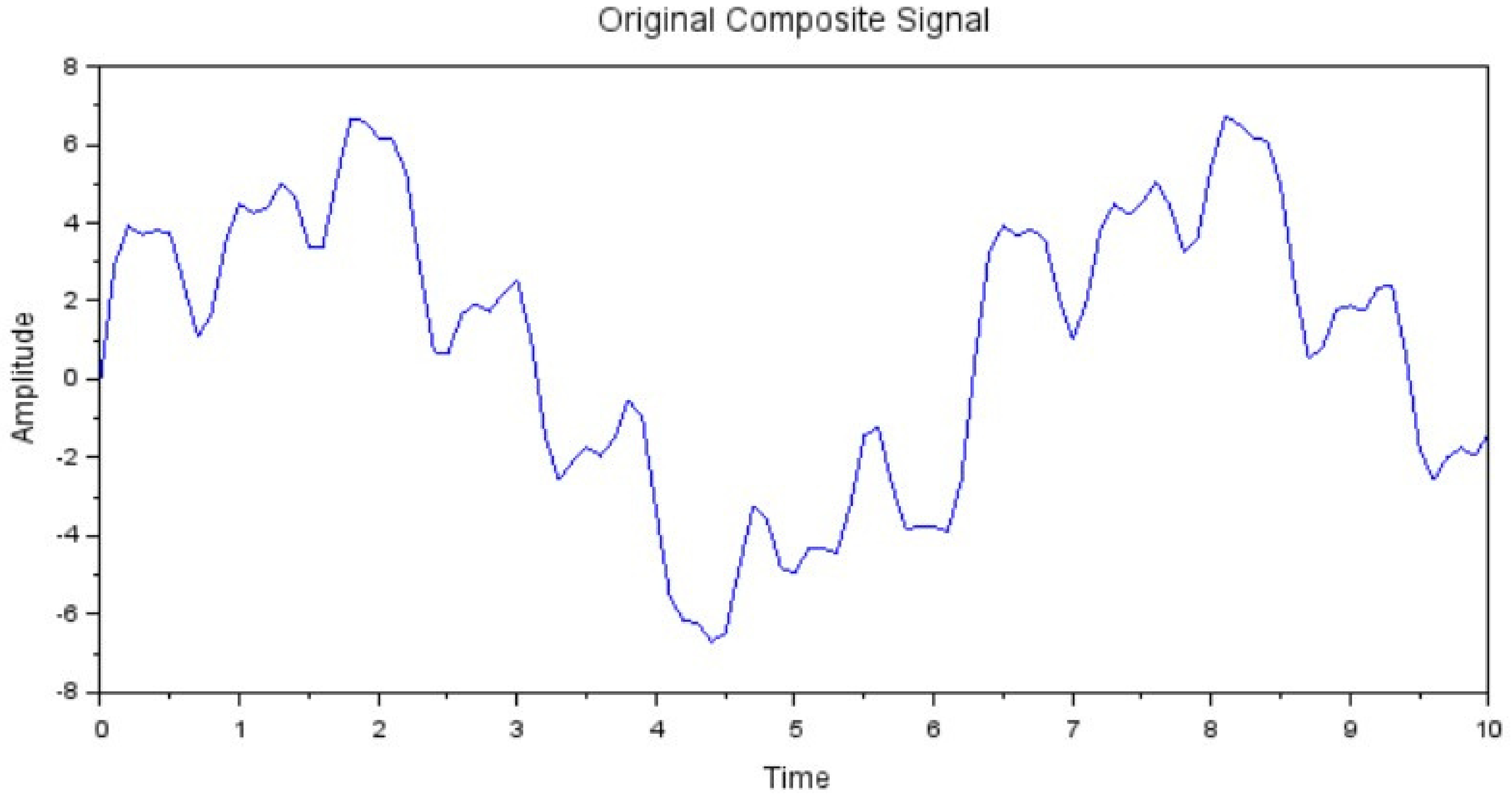
attenuation.sce (C:\Users\jahan\Desktop\DC innovative\attenuation.sce) - SciNotes

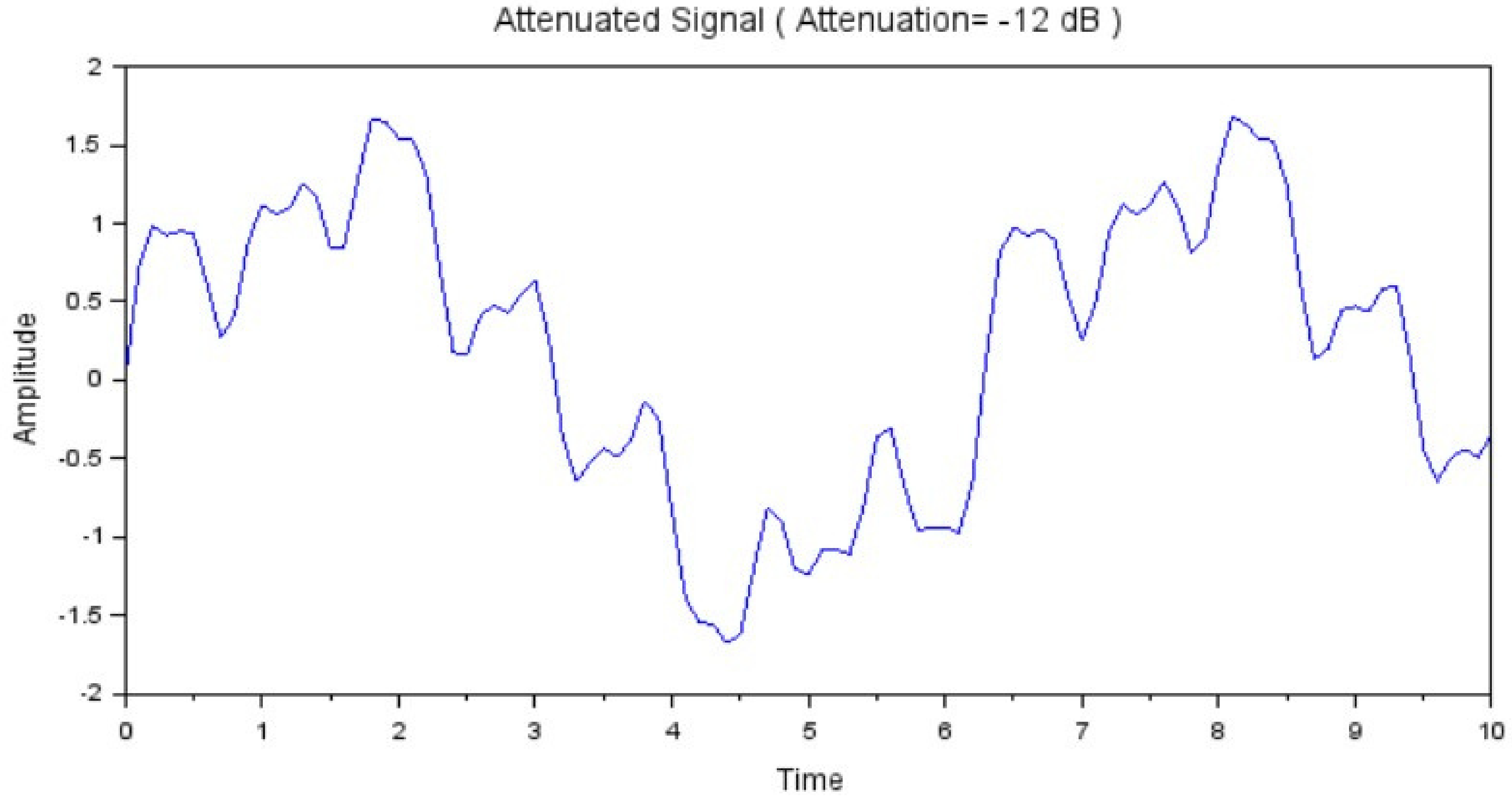
simple sine wave.sce | composite sine wave.sce | attenuation.sce | distortion.sce | noise.sce

```
// clear console
clc ;
clear ;
clf;
t =0:0.1:10;//time domain 0 to 10s

// Simple Sine Wave
// Original Signal
v1 = 20 * sin (2* %pi * t /5) ;
subplot (2 ,2 ,1) ;
plot (t , v1 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Original Signal');

// Attenuated Signal
v2 = v1/2 ;
subplot (2 ,2 ,2) ;
plot (t , v2 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Attenuated Signal ( Attenuation= -6 dB )');//att=10xlog(Pi/Po)

// Composite Wave
// Original Signal
v3=5*sin(t) + 5*sin (7*t)/3 + 5*sin (4*t)/5 + 5*sin (15*t)/7 + 5*sin (5*t)/9 ;
subplot (2 ,2 ,3) ;
plot (t , v3 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Original Composite Signal');

// Attenuated Signal
v4 = v3/4 ;
subplot (2 ,2 ,4) ;
plot (t , v4 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Attenuated Signal ( Attenuation= -12 dB )');
```


Original Signal
Amplitude
Time


Attenuated Signal (Attenuation= -6 dB)
Amplitude
Time


Original Composite Signal
Amplitude
Time


Attenuated Signal (Attenuation= -12 dB)
Amplitude
Time

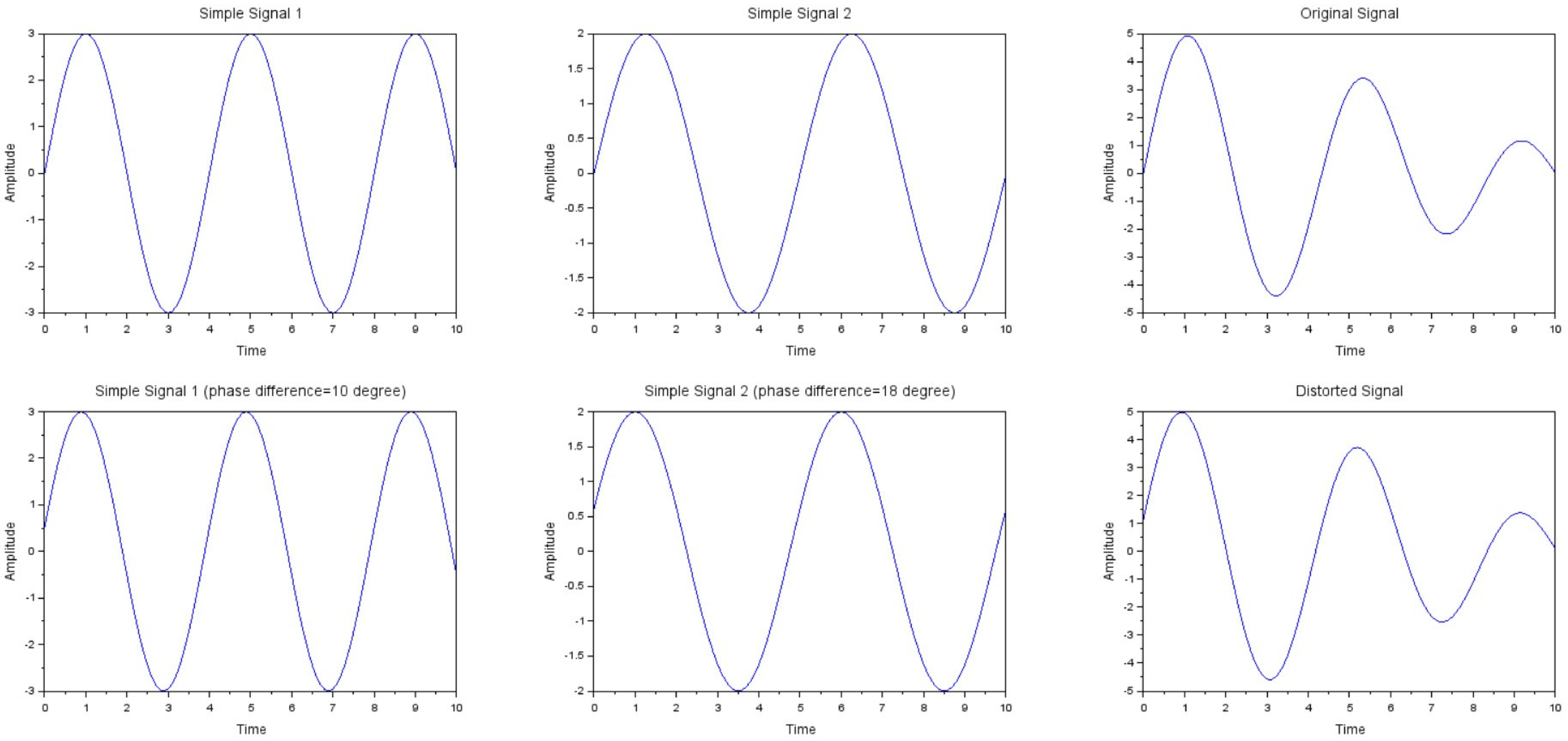
DISTORTION

- When a signal is distorted, its appearance or structure are altered.
- A composite signal comprised of several different frequencies is likely to lead to distortion.
- Each component of a signal travels through a medium at a different pace, which causes a delay in reaching its destination.
- Linear Distortion:
  A change in amplitude or phase without the addition of any new frequencies.
- Non-Linear Distortion:
  The generation of new frequency components results in non-linear distortion.
- Multipath Finding:
  Signals that go through multiple pathways and experience changes in their relative intensities and phases are said to be multipath.

distortion.sce (C:\Users\jahan\Desktop\DC innovative\distortion.sce) - SciNotes

simple sine wave.sce | composite sine wave.sce | attenuation.sce | distortion.sce | noise.sce

```

// Original Signal
v1 = 3 * sin(2*%pi*t/4) ;
subplot (2 ,3 ,1) ;
plot (t , v1 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Simple Signal 1');

v2 = 2 * sin (2*%pi*t/5) ;
subplot (2 ,3 ,2) ;
plot (t , v2 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Simple Signal 2');

v3 = v1 + v2 ;
subplot (2 ,3 ,3) ;
plot (t , v3 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Original Signal');

// Distorted Signal
v4 = 3 * sin(2*%pi*t/4+%pi/18) ;
subplot (2 ,3 ,4) ;
plot (t , v4 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Simple Signal 1 (phase difference=10 degree)');

v5 = 2 * sin (2*%pi*t/5 + %pi/10) ;
subplot (2 ,3 ,5) ;
plot (t , v5 ) ;
xlabel('Time');
ylabel('Amplitude');
title('Simple Signal 2 (phase difference=18 degree)');

v6 = v4 + v5;
```


Simple Signal 1
Simple Signal 2
Original Signal
Simple Signal 1 (phase difference=10 degree)
Simple Signal 2 (phase difference=18 degree)
Distorted Signal
Amplitude
Time

NOISE

- In electronics, noise is an unwanted disturbance in an electrical signal. Noise generated by electronic devices varies greatly as it is produced by several different effects. In communication systems, noise is an error or undesired random disturbance of a useful information signal.

TYPE OF NOISE

- Thermal Noise: Generated by the random motion of free electrons in a conductor resulting from thermal agitation.
- Induced Noise: The noise generated in a circuit by a varying magnetic or electrostatic field produced by another circuit.
- Impulse Noise: A non-continuous series of irregular pulses or noise spikes of short duration, broad spectral density and of relatively high amplitude
- Crosstalk Noise: A disturbance caused by the electric or magnetic fields of one telecommunication signal affecting a signal in an adjacent circuit.

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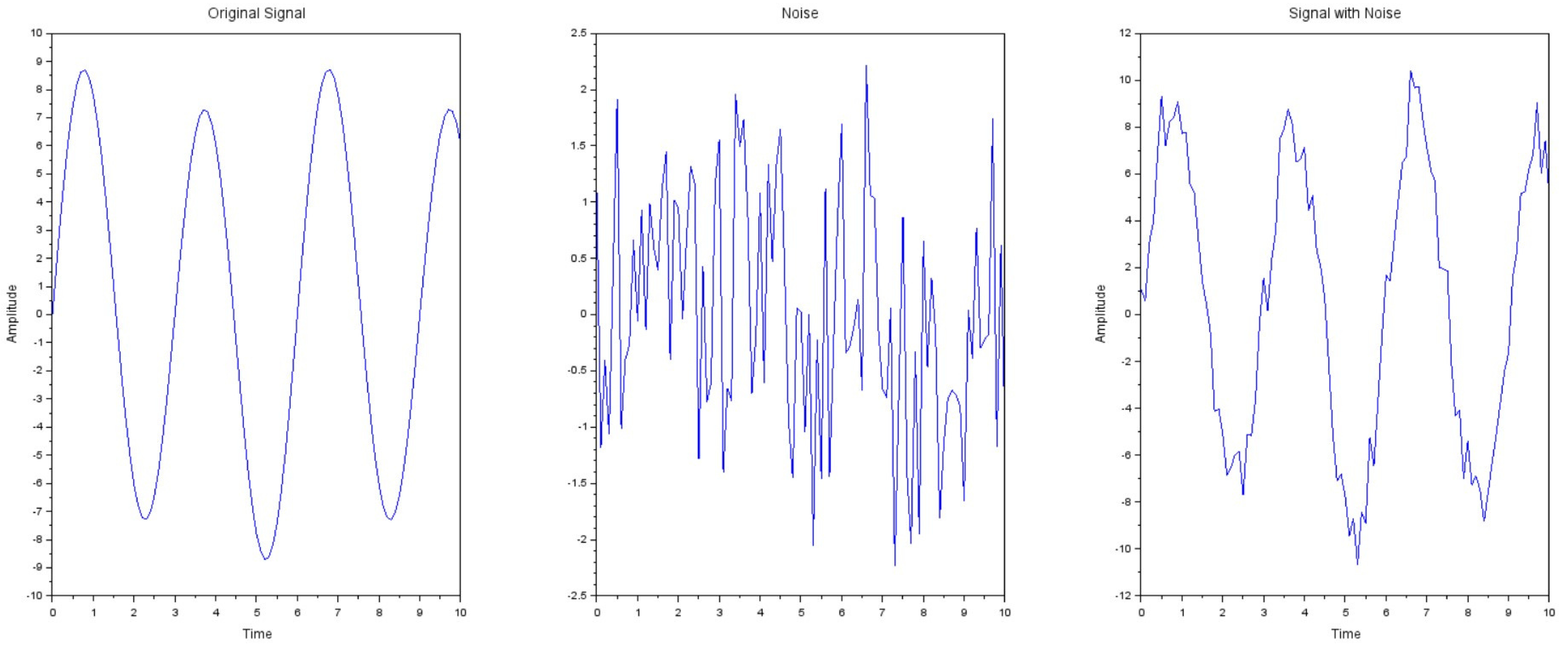

Original Signal
Amplitude
Time
Noise
Signal with Noise
Amplitude
Time

THANK YOU!

21BCE197 JANAM PATEL
21BCE200 KADAM PATEL
21BCE210 NEMI PATEL