C. V. Raman Global University
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Data and Signals

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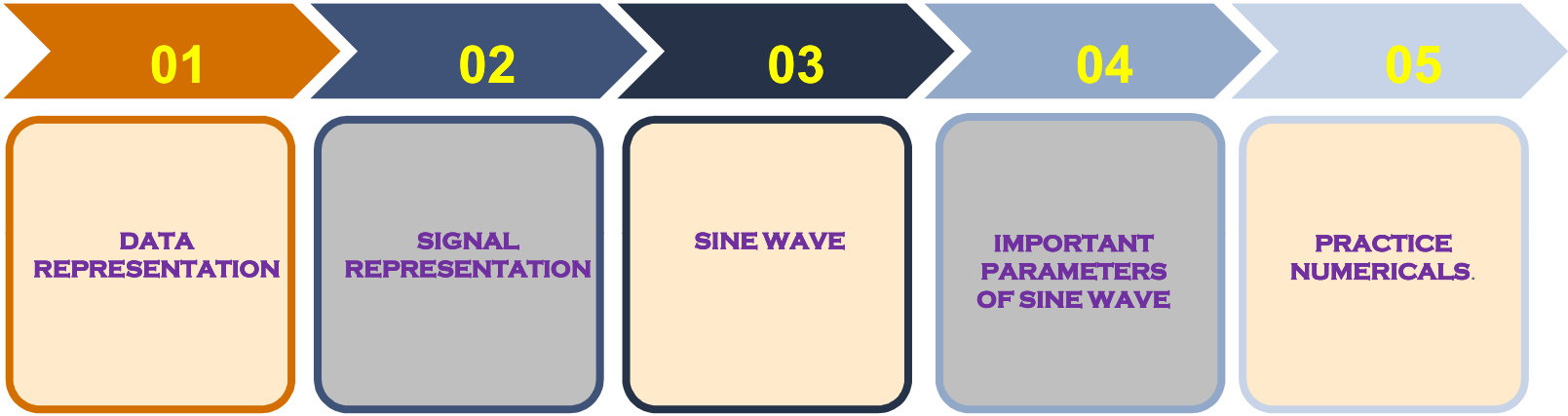
Today's Discussion

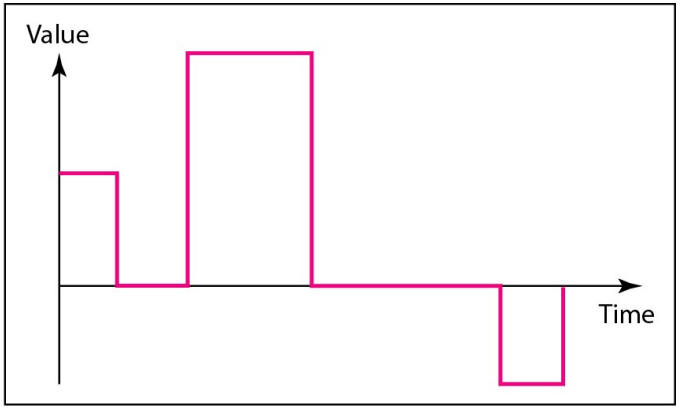


Data Representation

Data can be analog or digital.
Analog data are continuous and take continuous values.
Digital data have discrete states and take discrete values.

Signal Representation

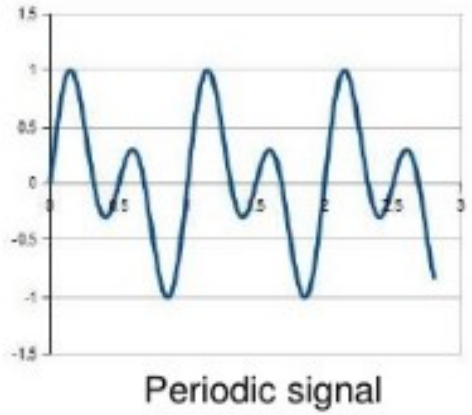
a. Analog signal



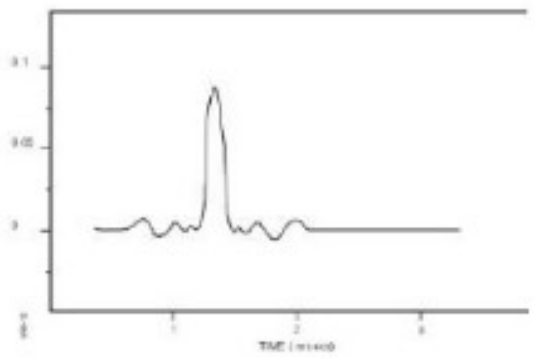
b. Digital signal

Analog signals can have an infinite number of values in a range; digital signals can have only a limited number of values.

Periodic and Non-periodic Signals



Periodic signal

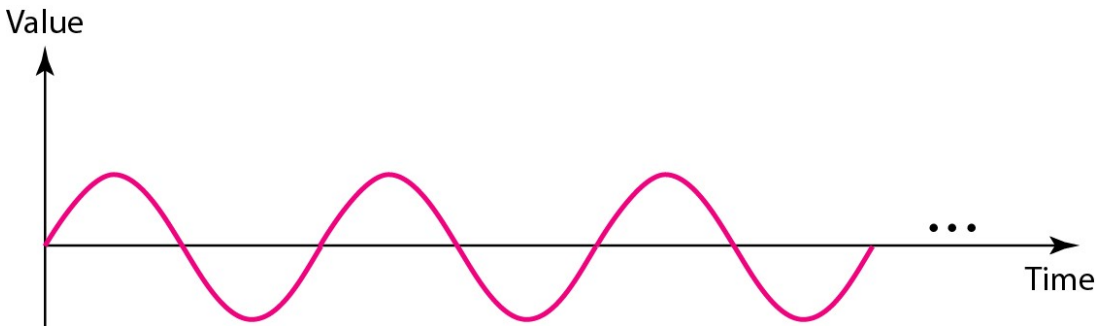


Non-periodic signal

In data communications, we commonly use periodic analog signals and non-periodic digital signals

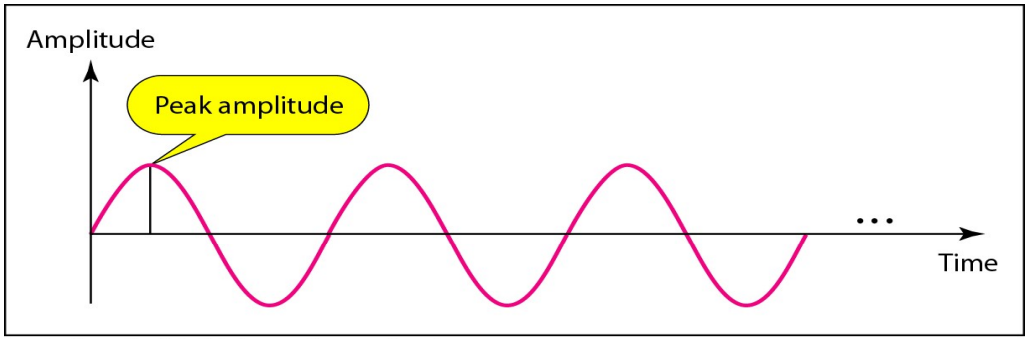
Periodic Analog Signal

- *Periodic analog signals can be classified as simple or composite.*
- *A simple periodic analog signal, a sine wave, cannot be decomposed into simpler signals.*
- *A composite periodic analog signal is composed of multiple sine waves.*

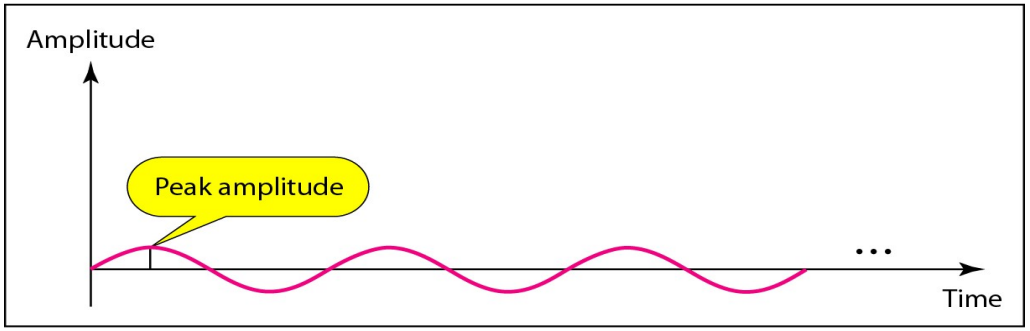


Sine wave

Parameters: Peak Amplitude

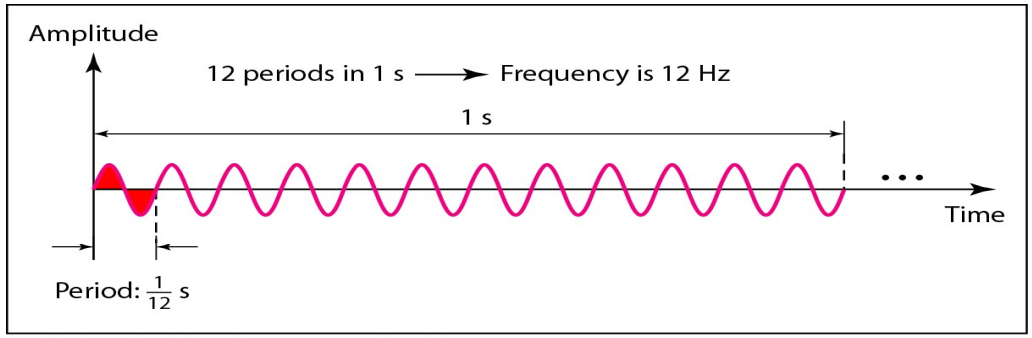


a. A signal with high peak amplitude

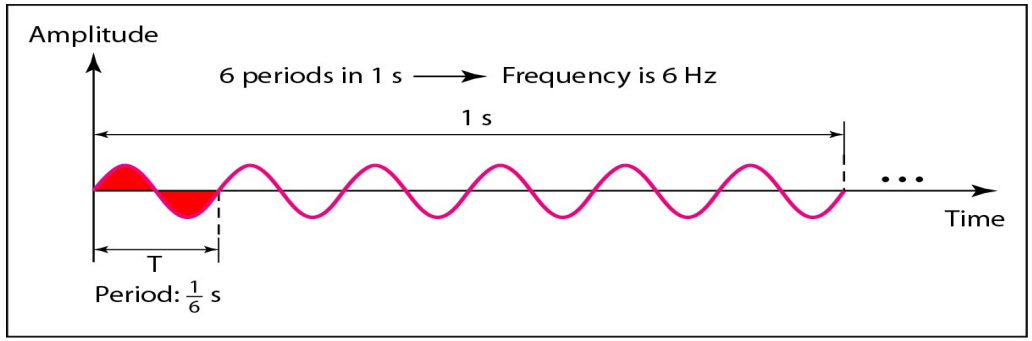


b. A signal with low peak amplitude

Frequency and Period



a. A signal with a frequency of 12 Hz

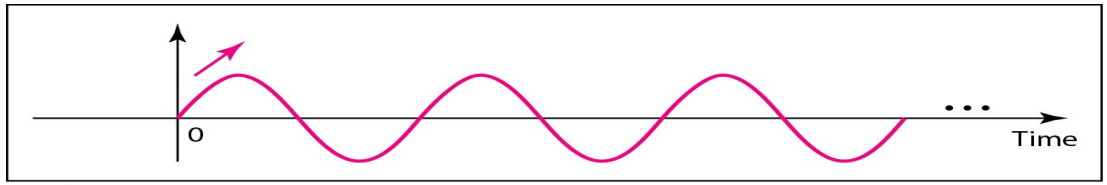


b. A signal with a frequency of 6 Hz

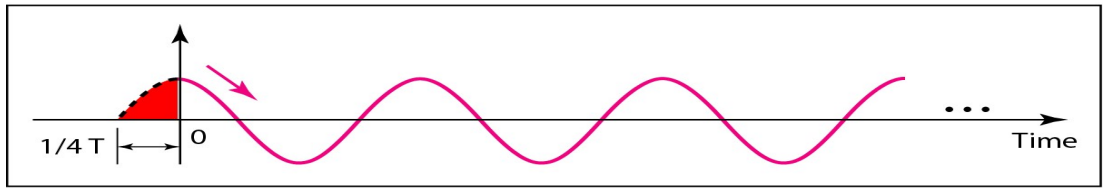
Frequency and period are the inverse of each other

$$f = \frac{1}{T} \quad \text{and} \quad T = \frac{1}{f}$$

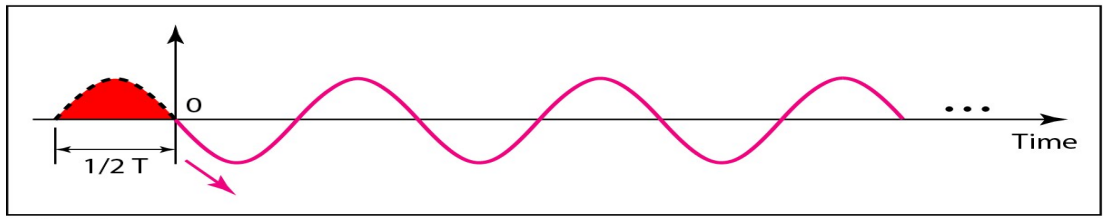
Phase



a. 0 degrees



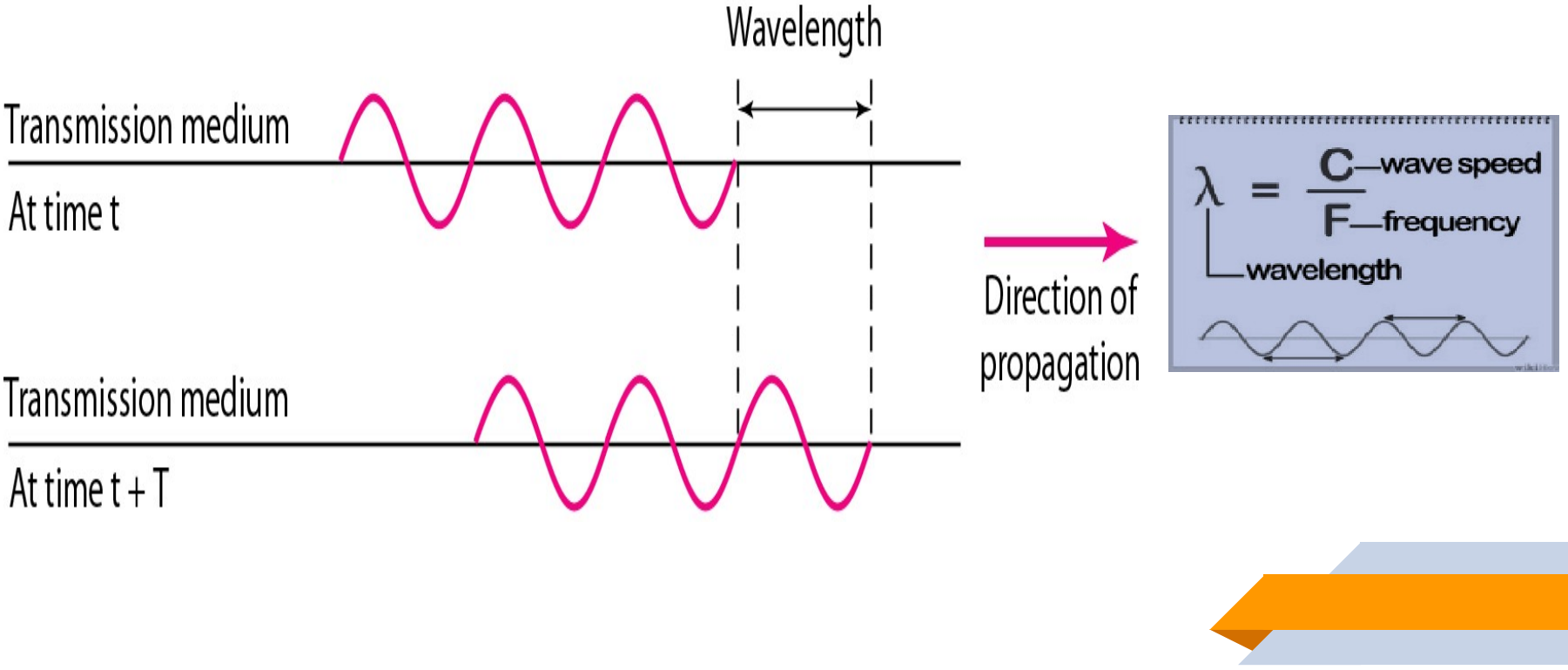
b. 90 degrees



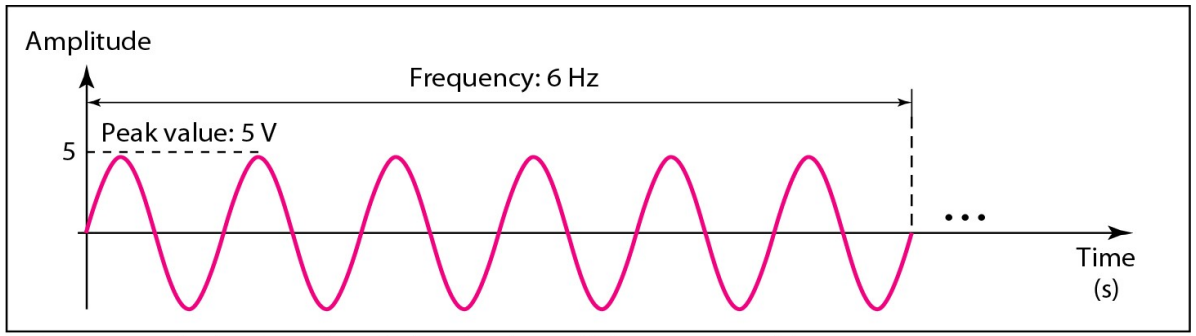
c. 180 degrees

Phase describes the position of the waveform relative to time 0.

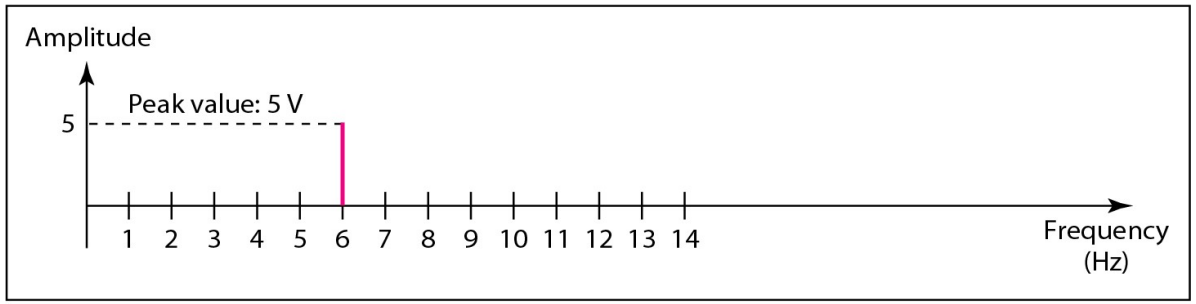
Wavelength


Wavelength
Transmission medium
At time t
Transmission medium
At time t + T
Direction of propagation
λ = C—wave speed / F—frequency
wavelength

Time Domain & Frequency Domain



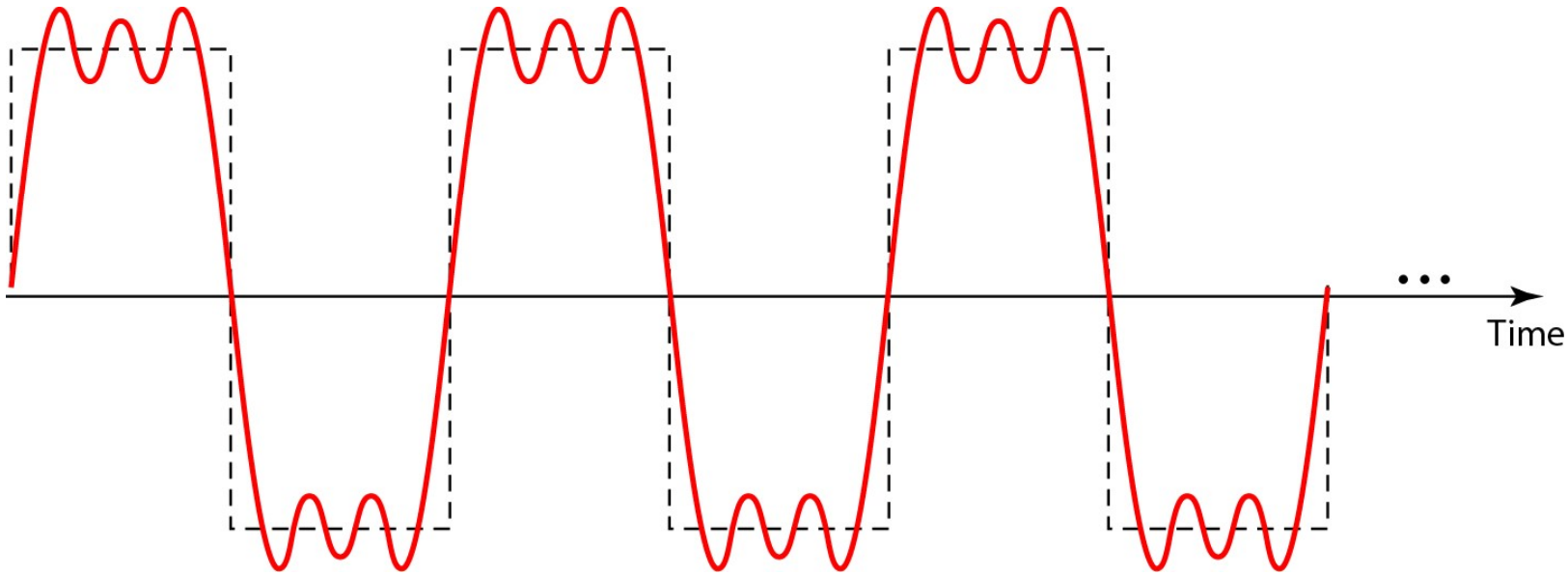
a. A sine wave in the time domain (peak value: 5 V, frequency: 6 Hz)



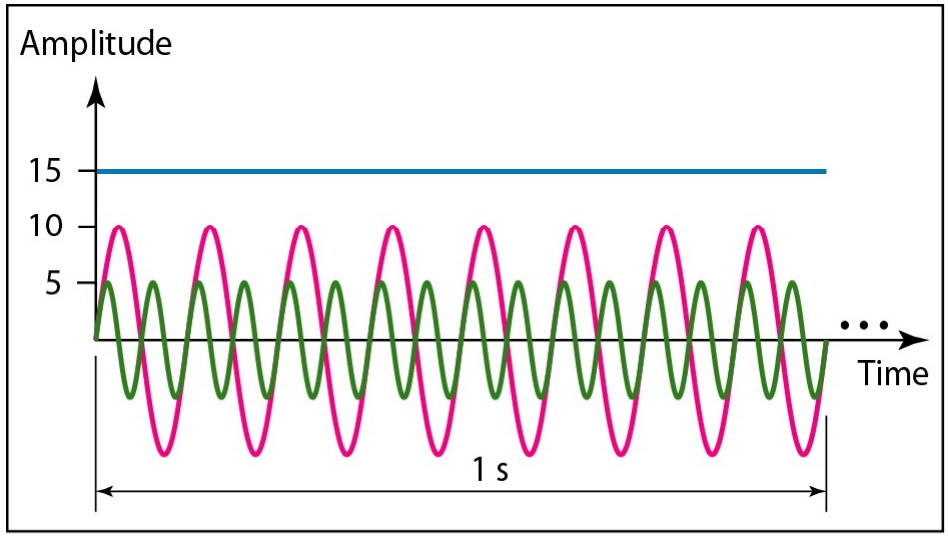
b. The same sine wave in the frequency domain (peak value: 5 V, frequency: 6 Hz)

Simple sine wave

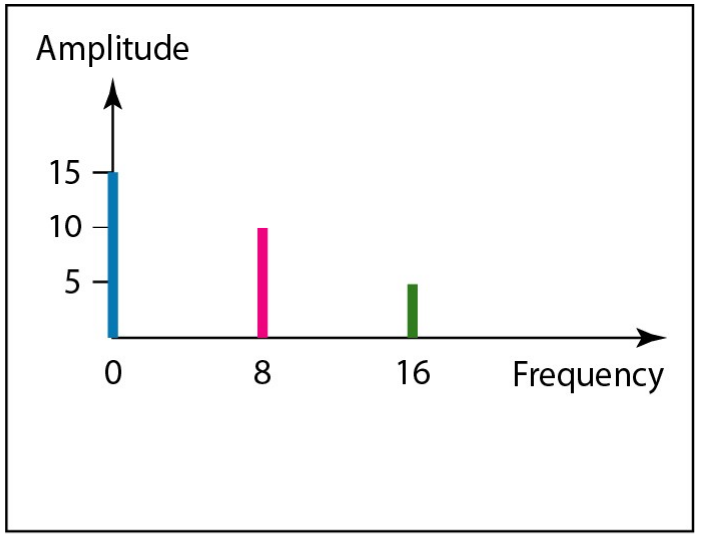
A Composite Periodic Signal



Time Domain and Frequency Domain



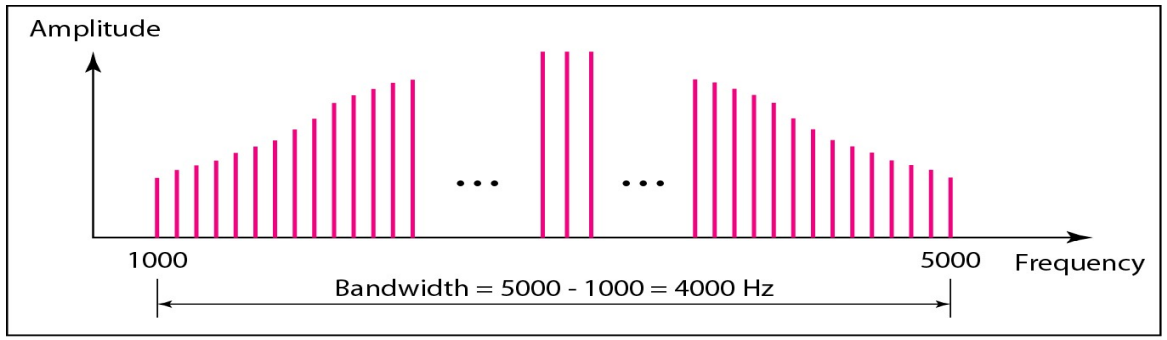
a. Time-domain representation of three sine waves with frequencies 0, 8, and 16



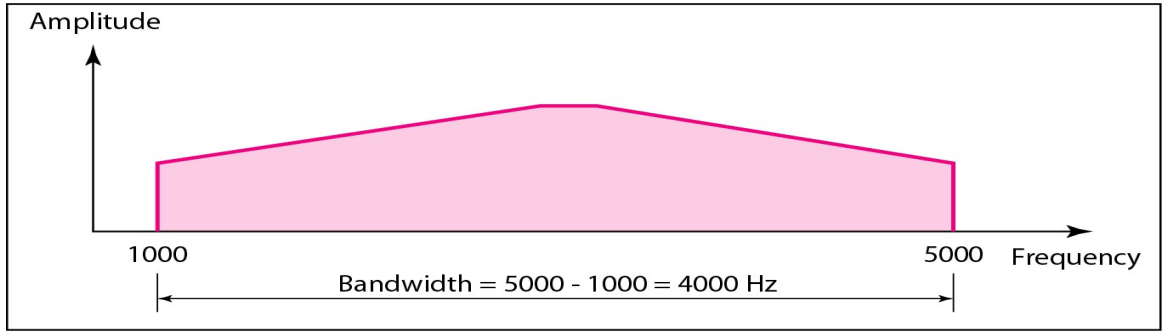
b. Frequency-domain representation of the same three signals

Composite Signal

Bandwidth



a. Bandwidth of a periodic signal



b. Bandwidth of a nonperiodic signal

Quiz Time

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Thank You

Any questions?