كلية الرشيد الجامعة
قسم هندسة تقنيات الحاسوب

المرحلة الثانية

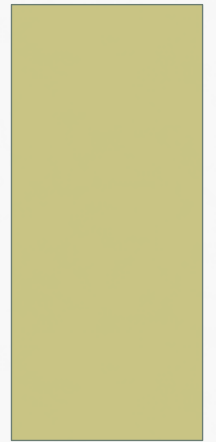اسس الاتصالات

المحاضرة رقم (١)

مدرس المادة : م.م تميم محمد

COMMUNICATION FUNDAMENTAL

THEORY AND PROBLEM

OF

SIGNAL AND SYSTEM

| Weeks	Syllabus
1st,2nd,3rd	Introduction to Signals and Systems: Test signals definition, signal classification ("Energy-Power", "Periodic-Non periodic", "Random-deterministic"), System Classification (Linear–Nonlinear, Time-varying and Time-invariant, Causal "Realizable" and Non Causal" Non-realizable"), System (Frequency) Transfer Function Overview, System Connection and their general Frequency Transfer function.
4th,5th,6th	Signal representation using Fourier Series: Complex (exponential) and Discrete forms, Signal Spectrum (Amplitude and Phase), Power Spectral Density "PSD", Parceval's theorem for power signals, Steady state Response for periodic signals, Spectrum for standard trigonometric functions
7th,8th,9th	. Signal Spectrum using Fourier Transform, "Fourier and Inverse Fourier" Transform relationship, Signal Spectrum (Amplitude and Phase), Fourier Transform Pairs for selected functions, Properties of Fourier Transform, Energy Spectral Density "ESD", Parceval's theorem for Energy signals. Steady State System Response for Non-periodic signals.
10th,11th,12th	Filters: Filtering action, Filters Classification based on (response:" ideal & practical" and mode), characteristics of filters response: Butterworth and Chebyshev response, decade & octave principles, Typical frequency response curve for LPF, HPF, Passive (lumped elements) Filters (RC,RL,RLC) and their response, Active Filters and Design Procedure, Frequency Transformation with circuits implementation.
13th,14th,15th ,16th,17th	Amplitude Modulation: DSBSC Generation, Quadrature Multiplexing, DSBSC Detection, Large Carrier AM Generation, Power Calculation and Detection, Frequency Division Multiplexing "FDM", SSB Modulation and Demodulation, Vestigial (VSB) Modulation, Signal – to – Noise Ratio in AM Reception. Typical Communication Circuits Design (Transmitter and Receiver)
18th,19th,20th,21th,22th	Frequency Modulation: Instantaneous Phase and Frequency, Narrow Band FM, Wide Band FM using Bessel Function, Commercial FM Transmission, Power Calculation in Angle Modulated Waveforms, Generation of WBFM, Detection for WBFM waveform, Phase Locked Loop "PLL", Signal – to – Noise Ratio in FM Reception, Typical Communication Circuits Design (Transmitter and Receiver)
23th,24th	Noise in communication systems: Noise in AM systems, Noise in FM Systems, Noise Figure Concept, Sky Noise Temperature, Equivalent System Noise Temperature

INTRODUCTION

A **System** is a term used to denote an entity that processes or operates on Signal(s) to transform one signal to another

A **signal** is a description of how one parameter varies with another parameter. For instance, voltage changing over time in an electronic circuit,

Input signal   SYSTEM   Output signal

SIGNAL

- Signal is representing a physical quantity or variable, and typically it contains information about behavior of the phenomenon.
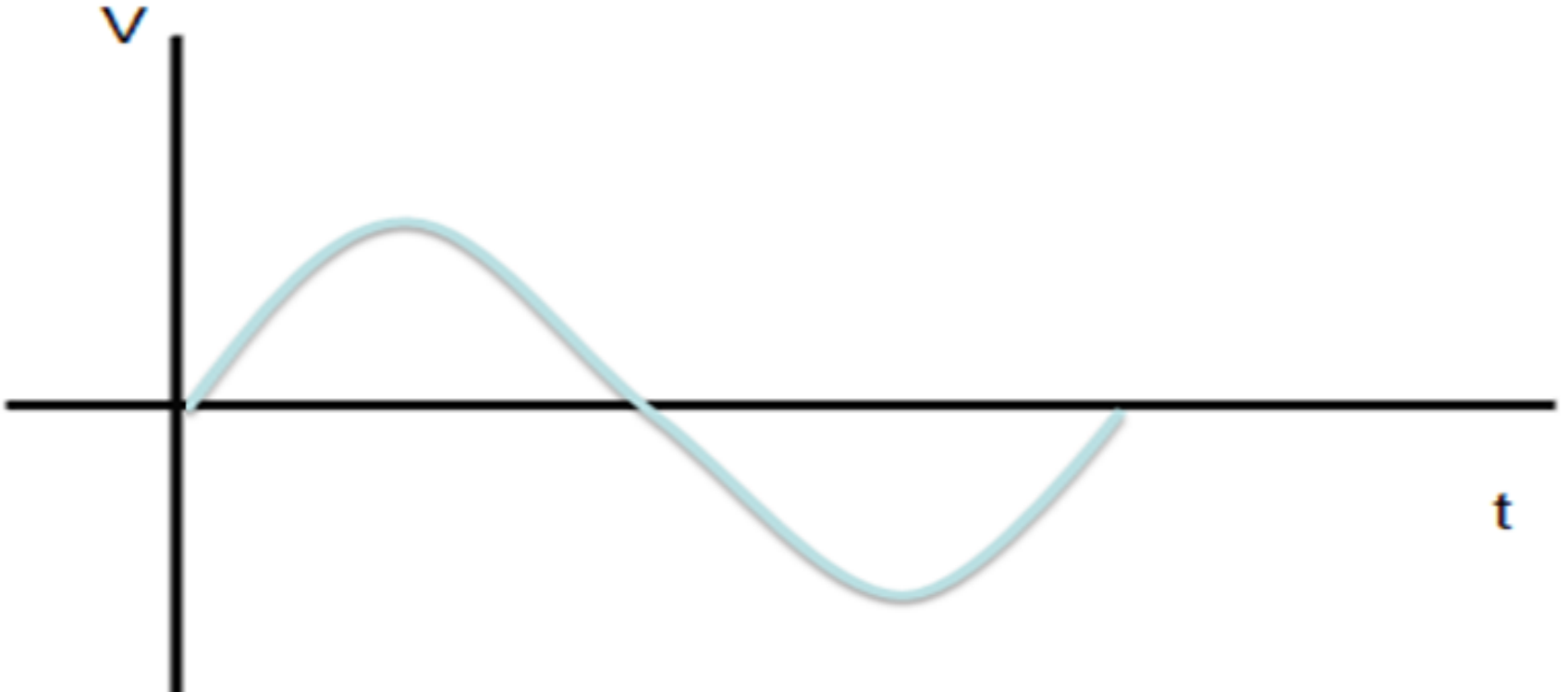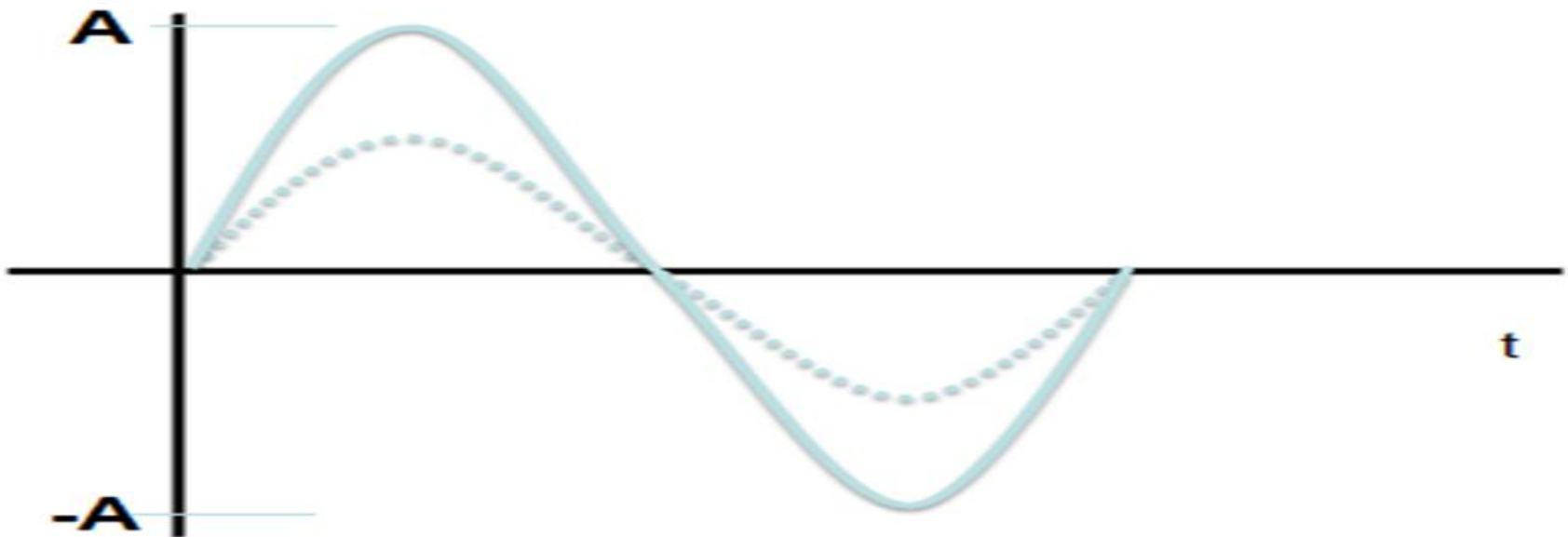
AMPLITUDE

- The peak value of sinusoidal AC **signals** is referred to as **amplitude** starting from the zero line.
- The **amplitude** usually refers to the scalar or vector field size.

AMPLITUDE

- The peak value of sinusoidal AC **signals** is referred to as **amplitude** starting from the zero line.
- The **amplitude** usually refers to the scalar or vector field size.

FREQUENCY

Frequency is the number of occurrences of a repeating event per unit of time.

frequency is the number of cycles per second in an ac sine wave.

Frequency is the rate at which current changes direction per second. It is measured in hertz (Hz), an international unit of measure where 1 hertz is equal to 1 cycle per second.
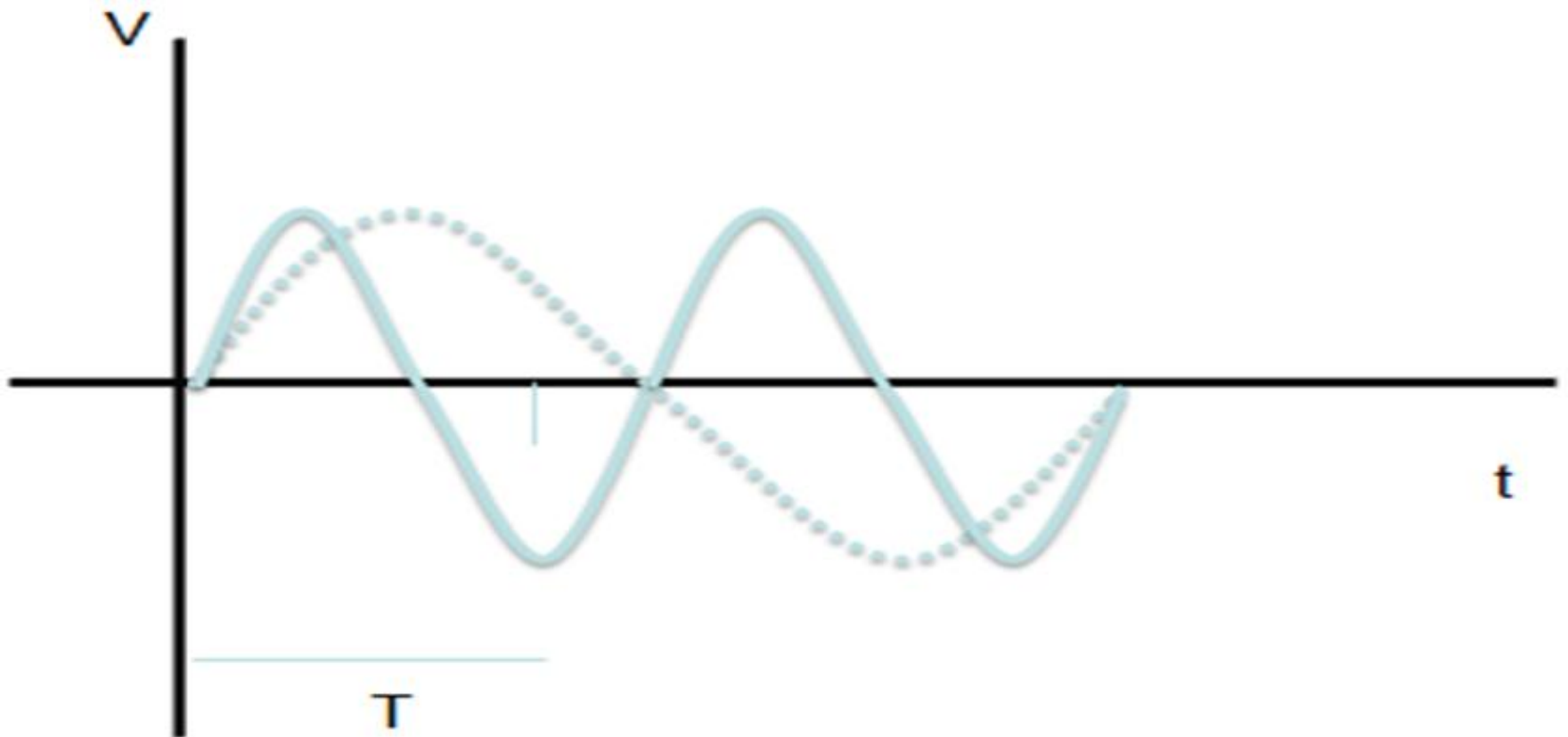
$$f = \frac{1}{T}$$

$$T = \frac{1}{f}$$

FREQUENCY

frequency is the number of cycles per second in an ac sine wave.

BANDWIDTH

- **Bandwidth** is a band of frequencies.
- The **bandwidth of a signal** is defined as the difference between the upper and lower frequencies of a signal generated.

$$bandwidth = f_{MAX} - f_{MIN}$$

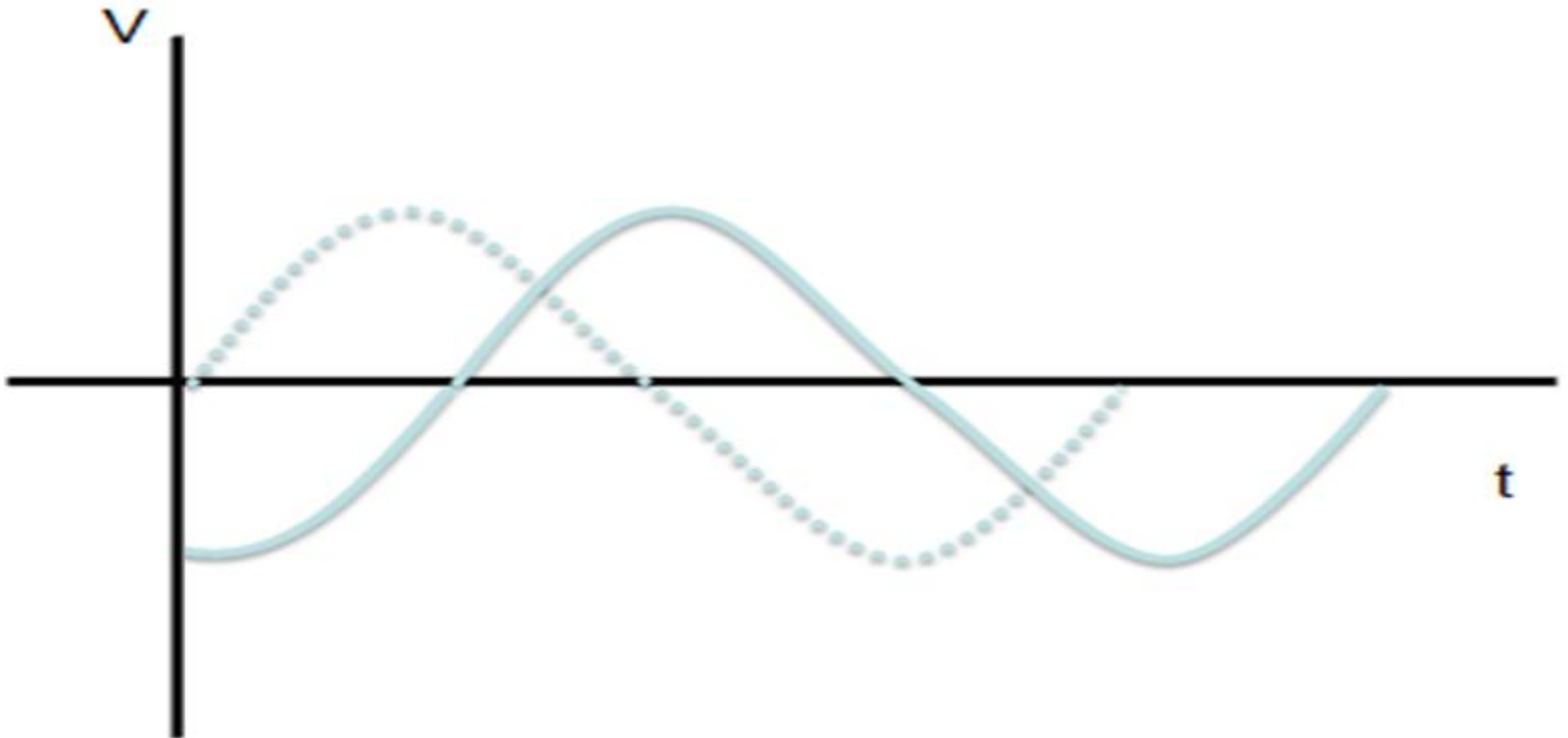$$20 \text{ kHz} - 20 \text{ Hz} = \sim 20 \text{ kHz}$$

$$\sim 4 \text{ kHz}$$

$$\sim 500 \text{ MHz}$$

PHASE

phase is a definition of the position of a point in time) on a waveform cycle.

PHASE