My Topics :—

* Discrete time signal.
* Discrete time system.
* Analysis of discrete time.

Number of Question:—

2020 : 1 – a, b, c

2 – a, b, c

3 – a, b, c, d

2019 : 1 – a, b, c

2 – b

6 – c

2018 : 1 – a, b, c

2 – a, b

3 – c

2017 : 1 – a, b

2 – a, b

2016 : 1 – a, c

3 – a

(a)

Signal: A signal is defined as any physical quantity that varies with time, space, or any other independent variable or variables. Mathematically, we describe a signal as a functions of one or more independent variable.

Example: $s_1(t) = 5t$, $s_2(t) = 20t^2$
linear quadratically

$s(x,y) = 3x + 2xy + 10y^2$, Signal of 2 independent variable x, y that could represent two spatial coordinate in a plane.

System: A filter used to reduce the noise and interference corrupting a desired information-bearing signal is called a system. The filter performs some operations on the signal, which has the effect of reducing the noise and interference from the desired information.

Signal processing:- When we pass a signal

through a system, as in filtering, we say that we have processed the signal. Signal processing involves analyzing, modifying & synthesizing signals to pull/exact meaning out of it. There are two types of signal processing: 1. Analog signal processing
2. Digital S.P.

(b)

Difference between analog and digital signals:

Analog signals	Digital signals
1. Analog signals is continuous and time varying.	1. Digital signals have two or more state and in binary form.
2. Troubleshooting of analog signals are difficult.	2. troubleshooting of digital signals are easy.
3. An analog signals is usually in the form of sine wave.	3. An digital signal is usually in the form of square wave.
4. Easily affected by noise.	4. These are stable and less prone to noise.
5. Analog signals may be affected during data transformation.	5. Digital signals are not affected during data transformation.
6. Analog signal use more power.	6. Digital signals use less power.
7. Ex: Temperature, pressure, Flow measurements, etc.	7. Ex: Valve Feedback, Motor start, Trip, etc.

c

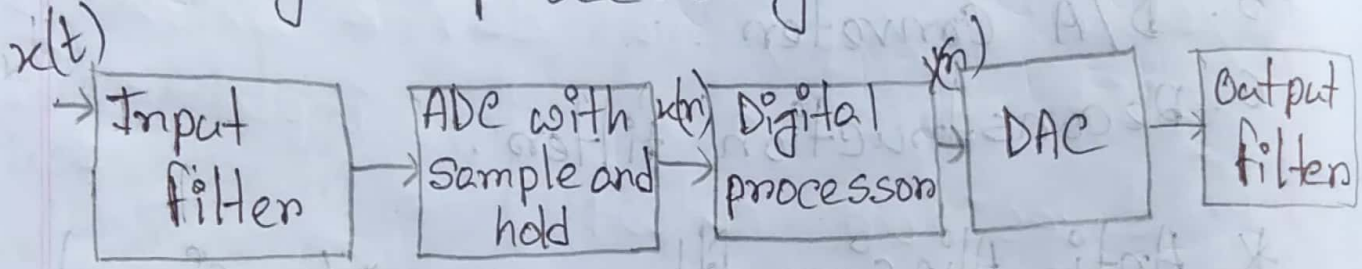
c) Explain the basic elements of a Digital signal processing system.

There are 6 basis elements of (DSP):

1. Anti-Aliasing-filter
2. Sample & Hold.
3. A/D converter.
4. DSP
5. D/A Conveter.
6. Reconstruction filter.

* Anti-Aliasing-filter: The I/O signal is applying to be antialising filter. This is a filter used to the high-frequency noise and Bond limit the signal.
* ~~Sample~~ & Sample & hold: The devices provides the input to the ADC and will be required if the I/O signals was not proper.
* A/D Converter: This a conveter which converts the analog s/g to the digital

* DSP: This gives the better quality signal
* D/A Converter: This device reconvenes the signal from digital signal to the Analog.
* Reconstruction filter: This filter is used to construct the signal properly after the signal processing.



Answer to the Question no 2

(a)

Define discrete time signal. How do you convent an analog signal into digital form- explain with example.

Ans: Discrete time signal: A signals is said to be discrete time signal when it is define at only discrete instance of time.

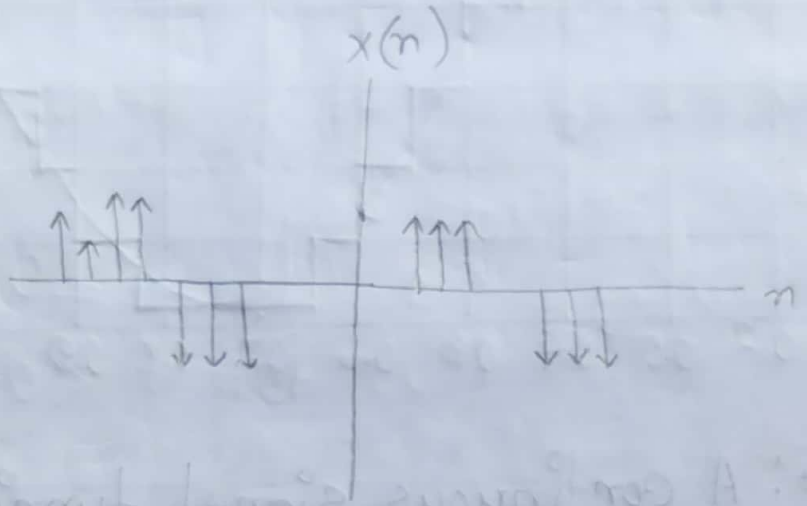


Fig: Discrete time signals

Analog signals are signals that have a continuous sequence with continuous value. These types of ~~value~~ signals can come from sound, light, temperature and motion. Digital signals are represented by a sequence of discrete

vales where the signal is broken down into sequence that depends on the time series or sampling rate. The easiest way to explain this is through a visual.

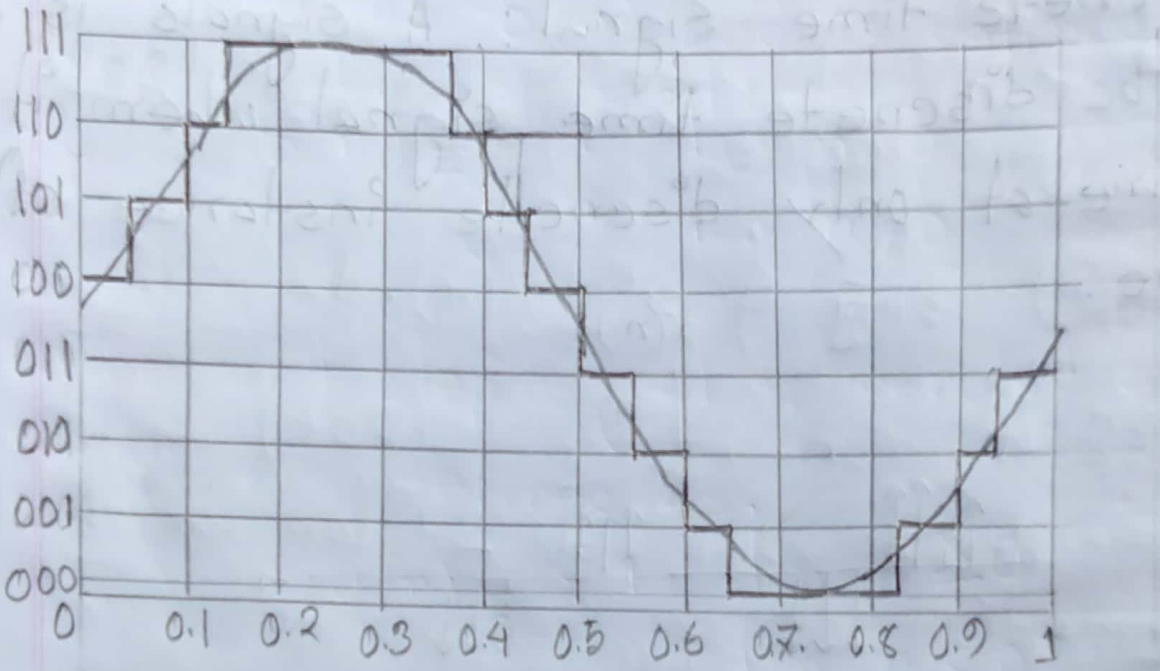


Figure: A continuous signal turning into adigital signal.

Micro controllers can't read the values unless it's digital data. This is because microcontrollers can only see "levels" of the voltage, which depends on the resolution of the ADC and the system voltage.

ADCs follow a sequence when converting anlog signals to digital. They first sample the signal, then quantify it to determine the resolution of signal and finally set binary values and send it to the system to read the digital signal. Two important aspects of the ADC are it's sampling rate and resolution.

(c)

Define sampling theorem?

Ans!- If a continuous time signals contains no frequency components higher than W hz, then it can be completely determined by uniform samples taken at a rate f_s samples per second where,

$$f_s \geq 2W$$

Or, in term of the sampling period

$$T \leq \frac{1}{2W}.$$

Answer to the Question no 3

(a)

Define unit sample and unit step sequence ?

Ans:- The unit sample sequence is denoted as $\delta(n)$ and is defined as

$$\delta(n) \equiv \begin{cases} 1, & \text{for } n = 0 \\ 0, & \text{for } n \neq 0 \end{cases}$$

The unit step signal is denoted as $u(n)$ and defined as,

$$u(n) \equiv \begin{cases} 1, & \text{for } n \geq 0 \\ 0, & \text{for } n < 0 \end{cases}$$

(b)

Difference between energy signal and power signal.

Ans:- Difference between energy and power signals are given below:

Power Signal	Energy Signal
1. Infinite duration	1. Finite duration.
2. Normalizied power is finite and non-zero.	2. Normalizied energy is finite and non zero.
3. Normalizied energy averaged over infinite time is infinite.	3. Normalizied power averaged over infinite time is zero.
4. Mathematically, tractable.	4. physically realizable.

(d)

Define lineanity of a signal.

Ans: Lineanity is the behaviour of a circuit, particulary an amplifien, in which the output signal strength varies in direct propontion to the inpul signal strength.

2019

Answer to the Question no 1

(a)

Similar as 2020 – 1(a)

(b)

Define aliasing effect?

Ans: Aliasing is an effect that causes different signals to become indistinguishable when sampled.

(c)

Described stable and unstable systems with example.

Ans:- Stability is an important property that must be considered in any practical application of system. Unstable systems usually exhibit erratic and extreme behavior and cause overflow in any particular implementation.

The condition that input sequence $x(n)$ and the output sequence $y(n)$ are bounded in translated mathematically to mean that there exist some finite numbers say M_x and M_y, such that

$$|x(n)| \leq M_x < \infty, \quad |y(n)| \leq M_y < \infty$$

for all n. If for some bounded input sequence $x(n)$. the output is unbonded the system is classified as unstable

Example:-

Consider the nonlinear system described by the input - output equation

$$y(n) = y^{2}(n-1) + x(n)$$

As an input sequence we select the bounded signal.

$$x(n) = C\,\delta(n)$$

where C is a constant. We also assume that $y(-1) = 0$. Then the output sequence is.

$$y(0) = C,\ y(1) = C^2,\ y(2) = C^4 \ldots\ y(n) = C^{2n}$$

Clearly, the output is unbounded when $1 < |C| < \infty$. Therefore, the system is bounded input - bounded output (BIBO) unstable.

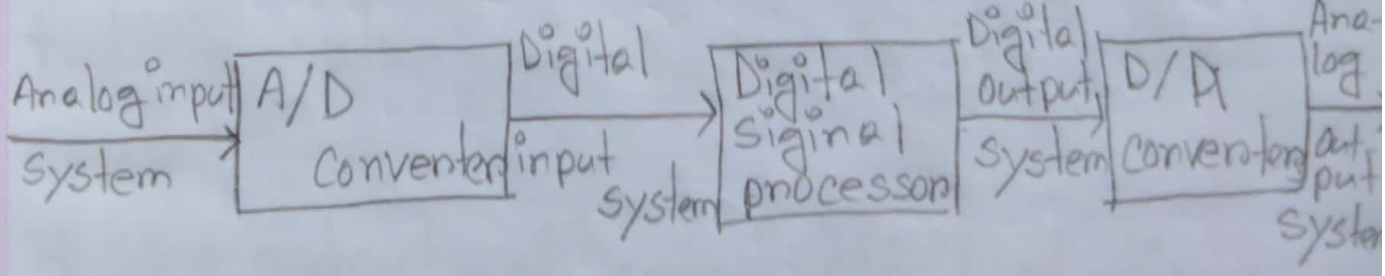
2018

Answer to the Question no 1

(a)

1@ Why signal processing is needed ? Draw the block diagram of DSP system and briefly ~~intro~~ introduce the different components of system.

Ans:- Digital signal processing is needed because it significantly increase the overall value of hearing protection. Unlike passive protection, DSP suppressen noise without blocking the speech signals.



Answer to the Question no 2

(a)

similar as 2019 - 2-(a) 1st part.

Answer to the Question no 3

(c)

Define causal and noncausal systems with examples. Determine if the following system are time invarient or time varient, $y(n) = x(-n)$

Ans:- If the output of any instant of time dependes on present and past values of the inputs but not on the future value of input ~~is~~ it's called causal.

If the output of any instant of time depents on ~~present~~ ~~and~~ ~~pas~~ future and past values of the inputs it's called noncausal.

Example:-

$$y(t) = x^2(t) + x(-4)$$

or, $$y(0) = x^2(0) + x(-4)$$

present — past.

It's causal.

$$y(t) = x(2-t) + x(t-4)$$

$$y(0) = x(2) + x(-4)$$

Future — past

It's called non causal.

Given that,

$$y(n) = x(-n).$$

$$\Rightarrow y(n,k) = x.(-n-k) \ldots$$

$$\Rightarrow y(n-k) = x(-n+k)$$

∴ It's time variant. because $y(n,k)$ and $y(n-k)$ are not same.

2017

Answer to the Question no 2

(a)

Consider a continuous-time system which has input of signal $x(t)$ and output of $x(t)\{u(t)$.

i. Is this system time ~~va~~ invariant? Justify your answer.

ii. Is this system linear? Justify your answer.

Ans:- (i) Given that,

$$x(t) = x(t) \cdot u(t)$$

$$\Rightarrow x(t,t_1) = x(t-t_1) \cdot u(t-t_1)$$

$$\Rightarrow x(t-t_1) = x(t-t_1) \cdot u(t-t_1).$$

∴ it's ~~is~~ time invariant.

Because, the time shift in the input the results the same connesponding time shift in the output then it is

called time invariant system if the output $x(t, t_1) = x(t - t_1)$, then the system is time invariant.

(ii).

2016

Answer to the Question no 1

(a)

Similar as 2020 - 1(c).

Answer to the Question NO 3

(a)

Similar as 2019 - 6(c)