BSS

CLASS-2

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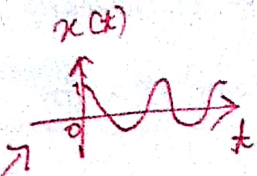
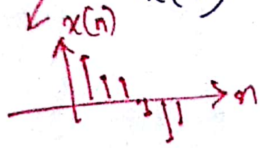


SIGNALS → Continuous-time s/g - defined for all instants of time
$x(t)$

→ Discrete-time s/g - defined only at discrete instants of time.
$x(n)$



* Meaning of discrete - individually separate & distinct.

* Continuous time signals represented by $x(t)$ and discrete time signals represented by $x(n)$, where t and n are independent variables in time domain.

* Four ways of representing discrete-time signals. They are—
  1. Graphical Representation.
  2. Functional Representation.
  3. Tabular Representation.
  4. Sequence Representation.

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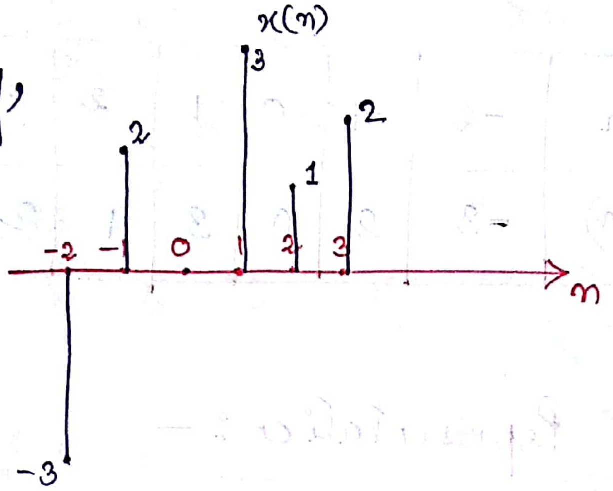
① Graphical Representation :-

Let us consider a s/g $x(n)$ with values

$x(-2) = -3$, $x(-1) = 2$, $x(0) = 0$, $x(1) = 3$

$x(2) = 1$ and $x(3) = 2$.

Graphically,



② Functional Representation :-

In this, amplitude of the signal is written against the value of 'n'.

Ex:- ① $x(n) = \begin{cases} -3 & \text{for } n = -2 \\ 2 & \text{for } n = -1 \\ 0 & \text{for } n = 0 \\ 3 & \text{for } n = 1 \\ 1 & \text{for } n = 2 \\ 2 & \text{for } n = 3 \end{cases}$

② $x(n) = \begin{cases} 2^n, & \text{for } n \geq 0 \\ 0, & \text{for } n < 0 \end{cases}$

Sampling is defined as the process of measuring the instantaneous values of continuous time s/g in a discrete form

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③ Tabular representation :-

Sampling instant 'n' and the magnitude of the signal at the sampling instant are represented in tabular form.

n	-2	-1	0	1	2	3
$x(n)$	-3	2	0	3	1	2

④ Sequence Representation :-

$$x(n) = \{-3, 2, \underset{\uparrow}{0}, 3, 1, 2\}$$

* Arrow mark '↑' denotes that $n=0$ term. When no arrow is indicated, the first term corresponds to $n=0$

$$x(n) = \{\underset{\uparrow}{-3}, 1, 0, 3, 1, 2$$

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SUM & PRODUCT OF DISCRETE-TIME SEQUENCE :-

$\{C_n\} = \{a_n\} + \{b_n\} \longrightarrow C_n = a_n + b_n$

$\{C_n\} = \{a_n\} \cdot \{b_n\} \longrightarrow C_n = a_n \cdot b_n$.

$\{C_n\} = k\{a_n\} \longrightarrow C_n = k\,a_n$

multiplication of a sequence by a constant, k, is obtained by multiplying each element of the sequence by that constant.

$$\{C_n\} = k\{a_n\}$$

$$\rightarrow C_n = k\,a_n$$

Elementary signals :-

Elementary / standard s/g

① unit step f^n

② Unit Ramp f^n

③ Unit Parabolic function

④ Unit impulse f^n.

⑤ Sinusoidal f^n

⑥ Real Exponential f^n.

⑦ Complex exponential f^n

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① UNIT Step-function

Step function :- exists only for the positive time & is zero for negative time.

Unit step function :- if a step function has unity magnitude.

Continuous-time unit step function $u(t)$ defined as,

$$\boxed{u(t) = \begin{cases} 1 & \text{for } t \geq 0 \\ 0 & \text{for } t < 0 \end{cases}}$$

Shifted unit step function $u(t-a)$ defined as,

$$\boxed{u(t-a) = \begin{cases} 1, & \text{for } t \geq a \\ 0, & \text{for } t < a \end{cases}}$$

$t-a \geq 0$

$t-a < 0$.

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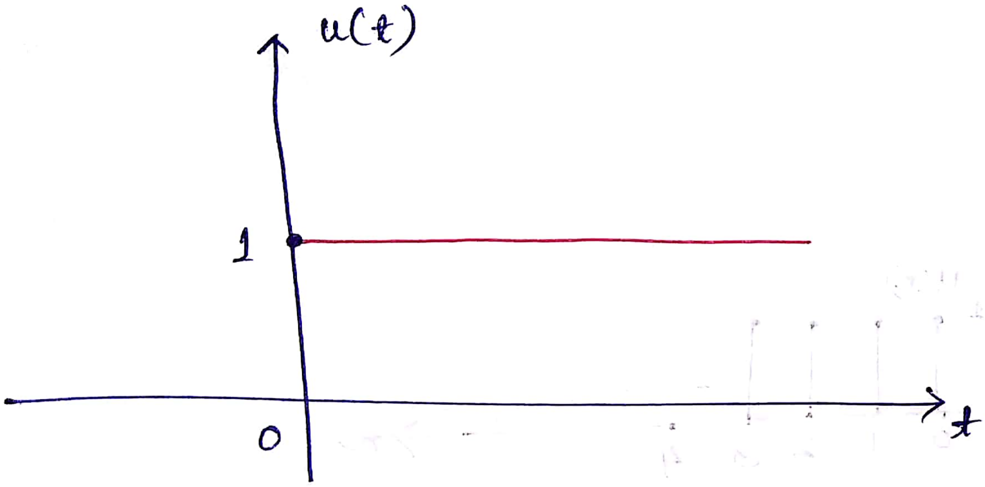

ⓐ unit step fn.

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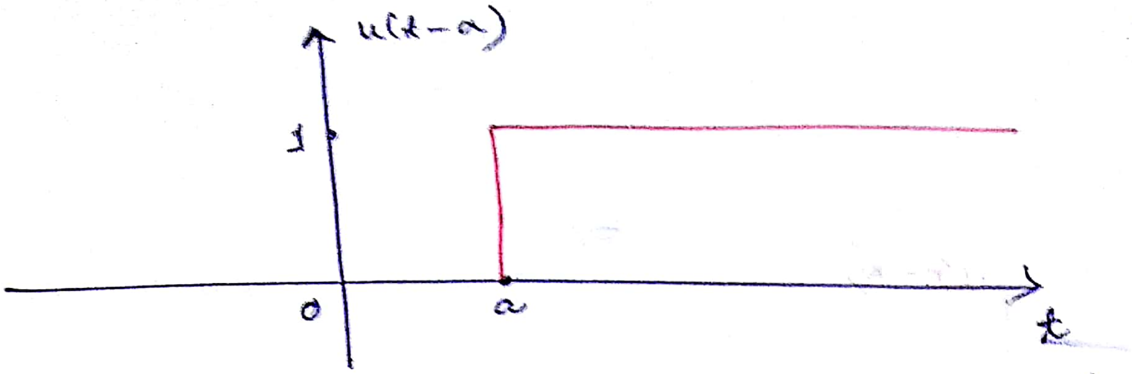

(b) Delayed unit step function.

Discrete - time unit step function :-

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

$$u(n-k) = \begin{cases} 1, & n \geq k \\ 0, & n < k \end{cases}$$

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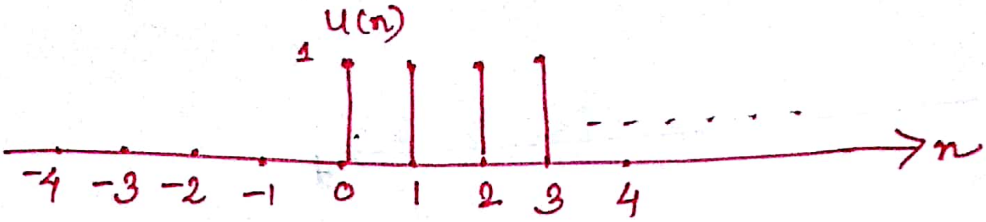
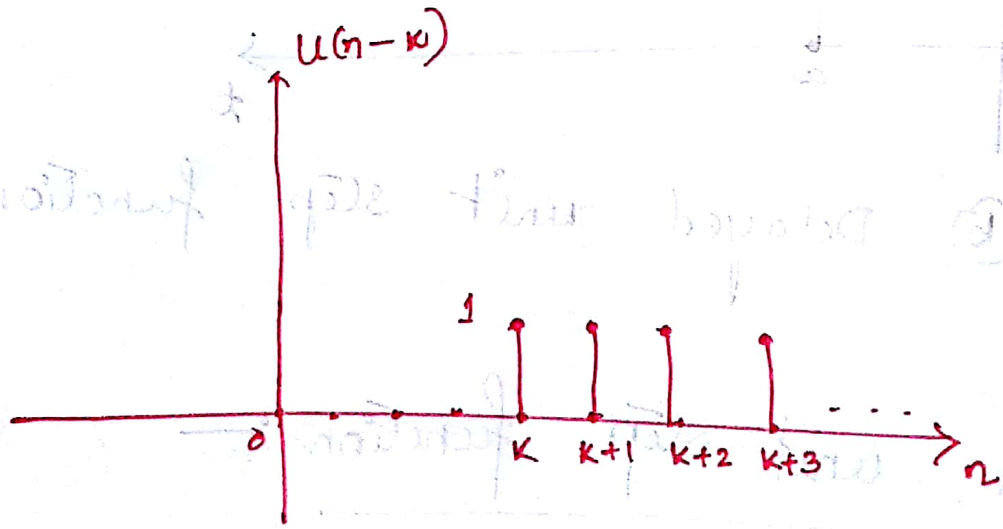


$u(n)$



$u(n-k)$

$u(n-2) \Rightarrow ?$

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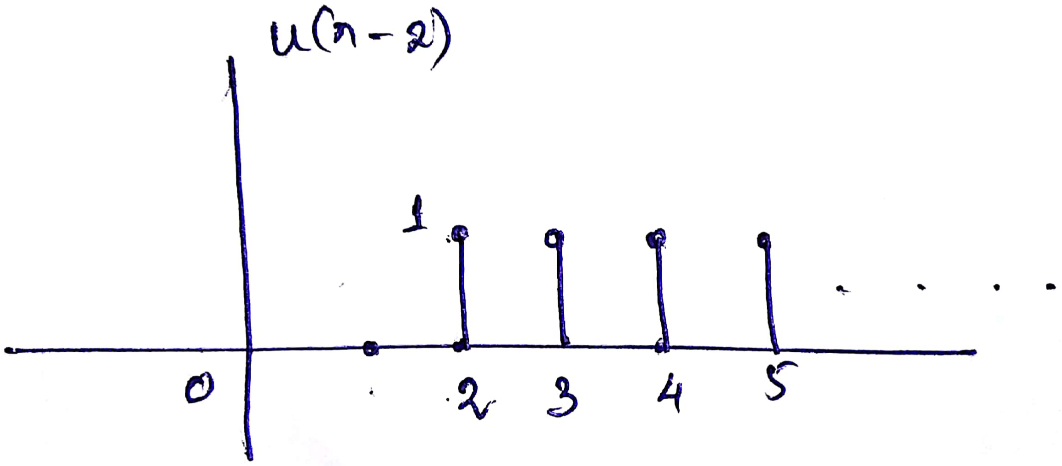
$u(n-2) \Rightarrow \{$



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