Circuit and Systems

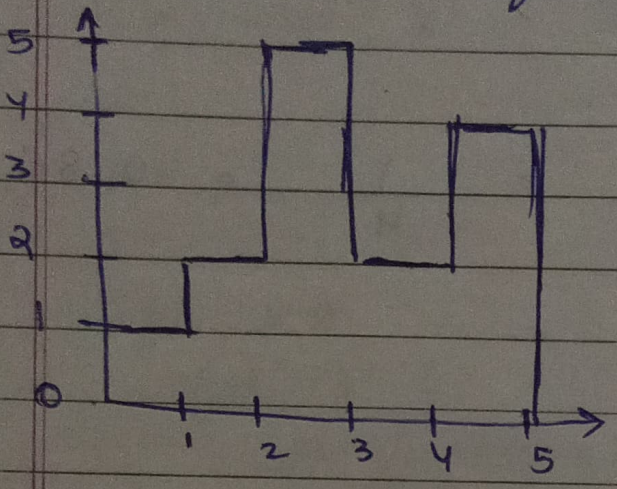
Assignment-1

Date
Page

Name - Syeda Rieha Quasar
Roll no. - 14114802719

Ans1. express the waveforms by standard signals

a)

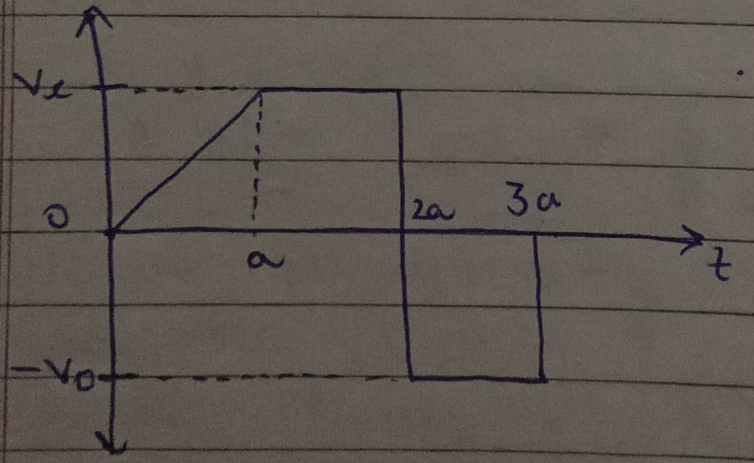


$f(t) = 1(u(t-0) - u(t-1))$
$+ 2[u(t-3) - u(t-4)]$
$+ 1[u(t-1) - u(t-2)]$
$+ 5[u(t-2) - u(t-3)]$
$+ 4(u(t-4) - u(t-5))]$

$f(t) = u(t) - u(t-1) + 2u(t-1) - 2u(t-2) + 5u(t-2) - 5u(t-3) + 2u(t-3) - 2u(t-4) + 4u(t-4) - 4u(t-5)$

$f(t) = u(t) + u(t-1) + 3u(t-2) - 3u(t-3) + 2u(t-4) - 4u(t-5)$

b)



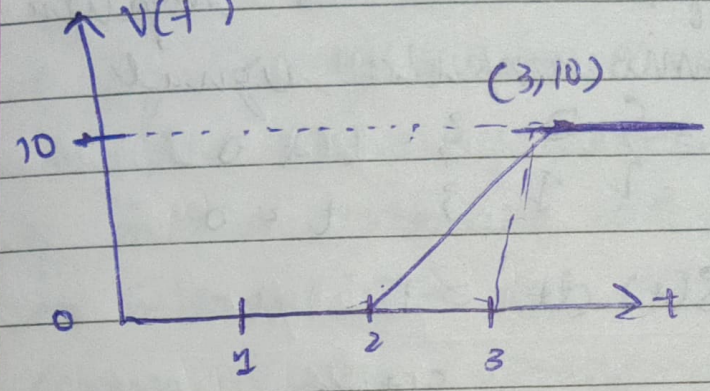
$f(t) = \frac{V_0}{a}(t)[u(t-0) - u(t-a)] + V_0[u(t-a) - u(t-2a)] - V_0[u(t-2a) - u(t-3a)]$

$f(t) = \frac{V_0}{a} t\,u(t) - \frac{V_0}{a} t\,u(t-a) + V_0(u(t-a) - V_0 u(t-2a) - \frac{a}{V_0} u(t-a) + V_0 u(t-3a))$

$$f(t) = \frac{V_0}{a} t\, u(t) - \left[\frac{V_0 t}{a} + V_0\right] u(t-a)$$

$$f(t) = -2V_0\, u(t-2a) + V_0\, u(t-2a)$$

(dw 2)



$$\text{Slope} = \frac{10-0}{3-2} = 10$$

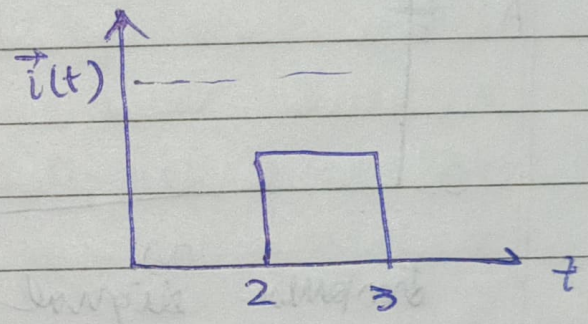
$$i(t) = \left(\frac{dv}{dt} \times \frac{dv}{dt}\right)$$

$$= m$$

$$i(t) = \frac{0.2}{\cancel{10}} \times 10^{-6} \times 10$$

$$= 2\ \mu A$$

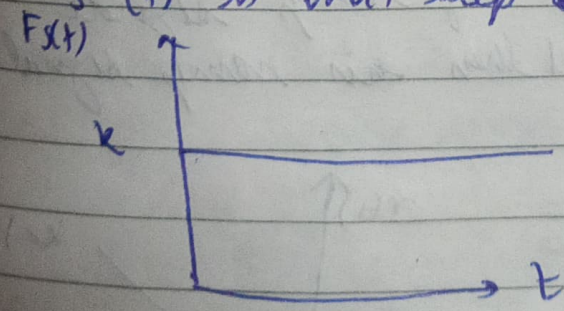
Derivative of Ramp Signal is Step signal



(dw 3) STEP SIGNAL : The step signal $F_s(t)$ is defined by

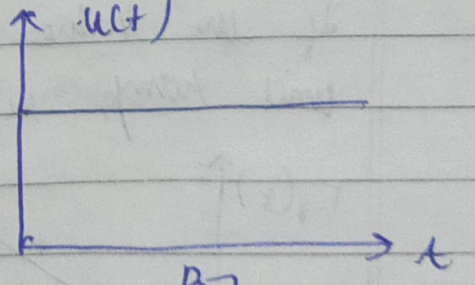
$$F_s(t) = \begin{cases} 0 ; & t < 0 \\ k ; & t > 0 \end{cases}$$

The value of $k < 1$ (unity), then this step signal $F_s(t)$ is unit step signal



A)

step signal



B)

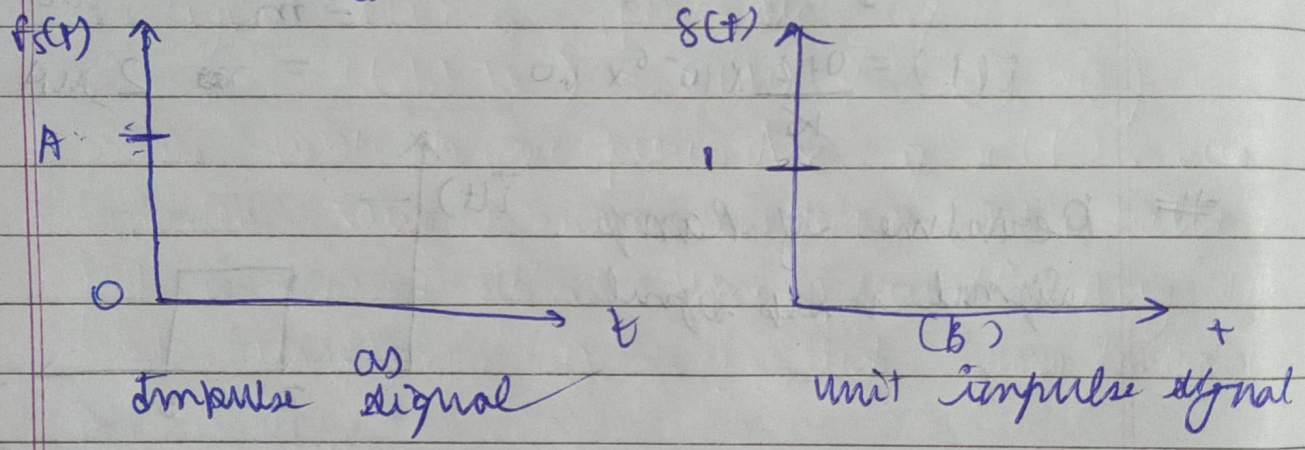
Unit step signal

IMPULSE SIGNAL → The impulse signal $F_s(t)$ is defined by. $F_s(t) = \begin{cases} 0 & t \neq 0 \\ A & t = 0 \end{cases}$

If the value of $A = 1$ then the impulse signal $F_s(t)$ is called unit impulse signal

$$\delta(t) = \begin{cases} 0 & ; \quad t \neq 0 \\ 1 & ; \quad t = 0 \end{cases}$$

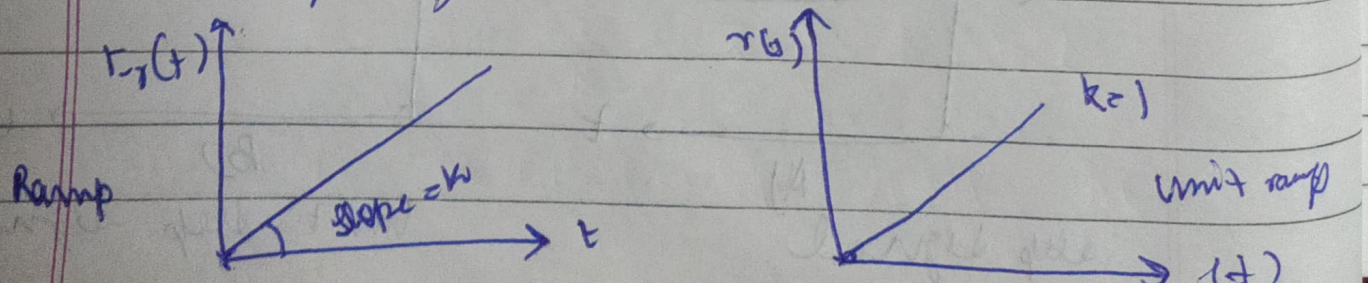
$$\text{Area} = \int_{-\infty}^{\infty} \delta(t)\, dt = 1$$



RAMP SIGNAL → Ramp signal is defined by

$$F_r(t) = \begin{cases} 0 & ; \quad t < 0 \\ k & ; \quad t \geq 0 \end{cases}$$

where k is the slope of ramp signal.
If the value of $k = 1$ then this ramp signal is called unit ramp signal



Relationship b/w Standard signals :

Derivative of step signal = IMPULSE

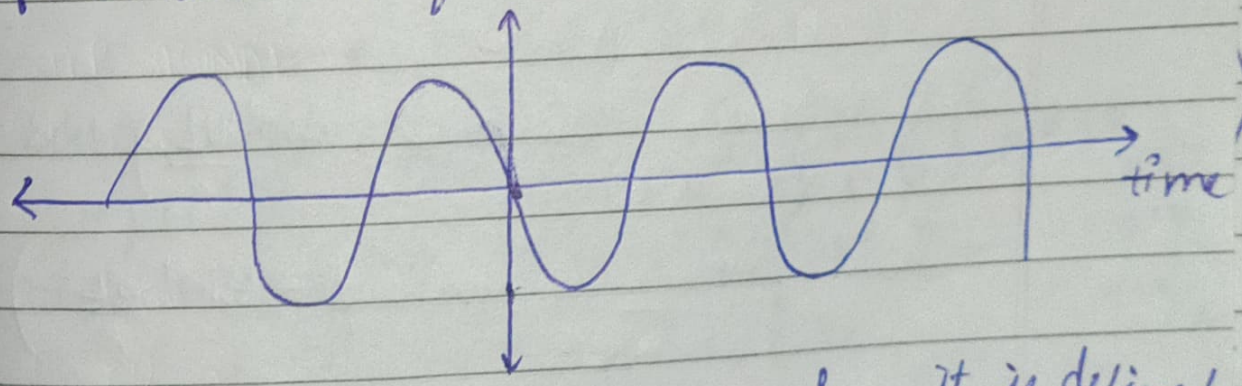
Derivative of ramp signal = STEP

A signal may be considered to be a function of time that represents a physical variable of interest associated with a system. Signals play an important role in science and technology as communication, aeronautics, bio-medical engineering, speech processing, etc.

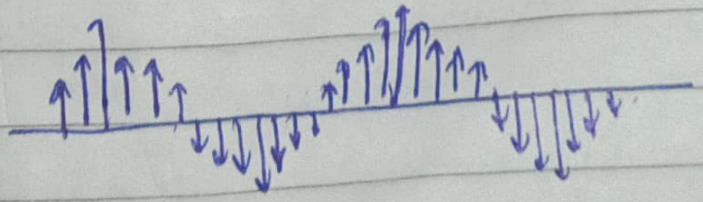
TYPES OF SIGNAL →

* Continuous time and Discrete-time signals :

A signal is said to be continuous when it is defined for all instants of time



A signal is said to be discrete when it is defined at only discrete instants of time



discrete

* Even and odd: A signal is even if $x(-t) = x(t)$ while discrete time signal is even if

$$x[-n] = x[n]$$

A signal is odd if it is -ve of its reflection $x(-t) = -x(t)$

$$x[-n] = -x[n]$$

* Periodic and non periodic:

A signal $x(t)$ is periodic if

$$x(t+T_0) = x(t) \quad \text{---} (1)$$

where least T_0 is periodic of $x(t)$. The smallest value of T_0 such that eq (1) is satisfied is referred to as time period. Any signal not satisfying (1) is called non periodic